Army Model and Simulation Standards Report FY99

Office of the Deputy Under Secretary of the Army
(Operations Research)
Army Model and Simulation Office

October 1998

Army Model and Simulation Standards Report FY99

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The *Army Model and Simulation Standards Report FY99* contains the status of the Army's efforts to standardize model and simulation (M&S) algorithms, heuristics, techniques, practices, and procedures. It also reflects the Army's FY99 M&S investments via the Army Model Improvement Program (AMIP) and the Simulation Technology Program (SIMTECH).

Standardizing of the Army's M&S processes is a vital step toward achieving the economies, efficiencies, and technological potential M&S represents. In order to support this effort, the Army Model and Simulation Office (AMSO) recently brought a pair of web-based tools on line. The Standards Nomination and Approval Process (SNAP; http://www.msrr.army.mil/snap) is designed to facilitate the Army's seven step standards development process. The Army Standards Repository System (ASTARS; http://www.msrr.army.mil/astars) serves as a repository for approved M&S standards.

The Army's efforts to establish a set of M&S standards directly supports the joint industry and Department of Defense (DoD) Simulation Based Acquisition initiative, as well as DoD's revolution in business affairs. I continue to expect each Standards Category Coordinator and team to be active, alert, and in touch with the rest of the M&S community in order to meet and support the Army's and DoD's technological and reuse objectives.

Our challenge is great and I invite all who have something to contribute to join the appropriate Standards Category team.

Walter W. Hollis
Deputy Under Secretary of the Army
(Operations Research)

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Army Model and Simulation Standards Report FY99

SCOPE

This report provides information on the status and areas of interest concerning the FY99 investments in the Army Model Improvement Program (AMIP) and the Simulation Technology Program (SIMTECH). It represents a corporate Army investment program to develop model and simulation standards throughout the Army in 19 standards categories.

PROPONENCY

The proponent for the *Army Model and Simulation Standards Report* is the Deputy Under Secretary of the Army for Operations Research, ATTN: SAUS-OR, The Pentagon, Army 102, Washington, D.C. 20310-0102. The functional manager is the Director, Army Model and Simulation Office, ATTN: DAMO-ZS, The Pentagon, Army 400, Washington, D.C. 20310-0400.

DISTRIBUTION and REPRODUCTION

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Copies may be requested from the functional manager.

A copy is maintained on the Army Model and Simulation Office world-wide web site (http://www.amso.army.mil).

CHANGES

Contact the Army Model and Simulation Office to discuss proposed revisions to this report.

SPECIAL NOTES

This document is an official Department of the Army publication. It is provided for information purposes within the Department of the Army. It does not authorize procurement, nor does it legally or contractually bind the government for purchase of any goods or services.

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Introduction and Purpose

The *Army Model and Simulation Standards Report FY99* provides a snapshot of the Army's Model and Simulation (M&S) standards efforts as work progresses towards the objective Army M&S environment. This report specifically documents projects approved for funding through the AMIP and the SIMTECH program. It also provides background information on the standards categories, the organizations, and individuals involved in the Army's M&S Standards Development Process.

Vital investments occur under both the AMIP and SIMTECH programs. During August 1998, the Army Model and Simulation Office (AMSO) convened a meeting of the Policy and Technology Working Group (P&T WG) to evaluate and prioritize proposed AMIP and SIMTECH projects for FY99. The Army Model and Simulation Executive Committee reviewed the prioritized list of projects (Appendices D and E) and made recommendations to the Deputy Under Secretary of the Army for Operations Research (DUSA(OR)), the final approval authority for AMIP and SIMTECH funding.

Since the publication of last year's Standards Report, a new Standards Category has been added – Command, Control, Communication, Computers, and Intelligence (C4I) Integration – and two Standards Categories were renamed in order to more accurately reflect their direction. Control, Communications, and Computer Systems (C3S) is now Communication Systems, and Dynamic Environments is now Dynamic Atmospheric Environments. In addition, three new Army M&S Areas of Special Interest were added: Information Operations, Weapons of Mass Destruction, and Emulation and Stimulation.

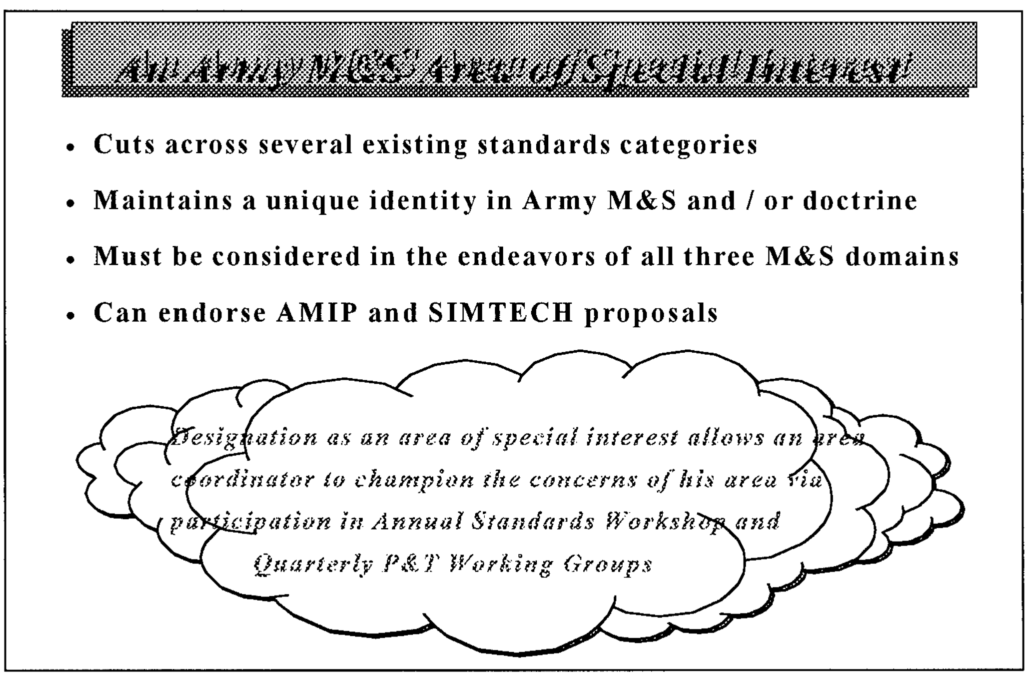

FIGURE 1. Definition of an Army M&S Area of Special Interest

THE ARMY MODEL IMPROVEMENT PROGRAM

The AMIP provides funding to organizations to execute projects that support the achievement of standards category objectives. Each fiscal year, Standards Category Coordinators (SCCs) nominate M&S projects that further objectives within their respective category. The project nominations are included as part of each SCC's Annual Standards Category Report. The SCCs and their team prioritize multiple nominations to indicate which project addresses the most pressing standards requirement within that category. The nominations are integrated and prioritized by the P&T WG and submitted through the AMSEC to the DUSA (OR) for approval. Additional project nomination guidance is in Appendix B of the *Army M&S Master Plan.*

SIMULATION TECHNOLOGY PROGRAM

The SIMTECH program complements the AMIP. Where the AMIP invests in technologies that are fairly well developed and have a high probability of developing a standard, SIMTECH invests in developing state-of-the-art M&S technologies. The SIMTECH program focuses on accelerating the development and transfer of emerging technologies to improve the art and science of M&S in all functional disciplines. The specific SIMTECH program goals are to:

1. Improve M&S development and modification techniques;

2. Ensure Army M&S more easily and accurately represents complex processes;

3. Develop less expensive technologies that maintain or improve M&S quality;

4. Develop techniques that increase M&S interoperability among and between M&S domains; and

5. Provide state-of-the-art environments in Army commands and agencies that will attract and retain highly skilled personnel for M&S research and development.

One important SIMTECH program role is to transition SIMTECH developed applications, techniques, and procedures to the AMIP, where they may be applied to critical, near-term Army M&S standards needs. Additional project nomination guidance is in Appendix B of the *Army M&S Master Plan.*

WHAT IS AN ARMY M&S STANDARD?

Webster's II New Riverside University Dictionary defines a standard as "a rule, principle, or measurement established by authority, custom, or general consent as a representation or example." The term M&S standard is applied in the broadest context to include procedures, practices, processes, techniques, and algorithms. Standards for M&S cover a variety of topics and the type and source of relevant standards will vary with each standards category. The Army M&S Master Plan describes three levels of standards. Draft Standards are initial or proposed standards. These standards have not completed the review and approval process. Approved standards are the next higher-level. These standards have been reviewed and demonstrated sufficient maturity and consensus to warrant their recommendation to the DUSA OR for approval. Mandatory Standards are the highest-level of standards and are promulgated by regulation or policy statement. Developers and users of Army M&S systems must follow these standards. An example of a mandatory standard is the DOD High Level Architecture for simulations. While some may raise short-term costs for individual programs, the value in adopting standards is their overall and long-term benefit to the Army.

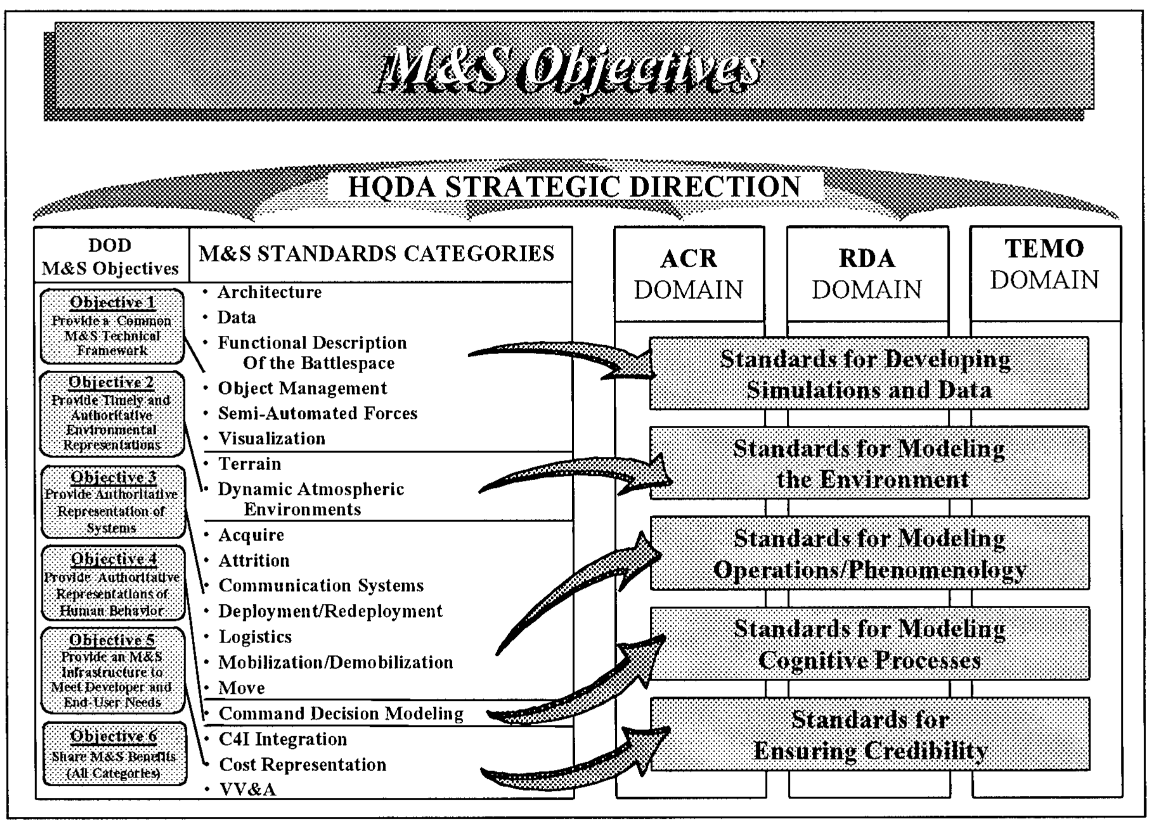

FIGURE 2. DoD M&S Objectives

WHY ESTABLISH ARMY M&S STANDADS

Simply put, the Army seeks to develop standards to improve M&S interoperability and credibility while also increasing commonality and reuse. Through the development of M&S standards the Army hopes to:

- enable simulations to provide or accept services from one another thus making them more interoperable;
- improve the credibility or acceptance of M&S representations;
- increase commonality in the depiction of the synthetic environment; and
- establish a baseline for reusing standard algorithms and heuristics in future simulations.

The use of approved M&S standards also benefits V&V as well as Accreditation. Via the Army's M&S Standards Development Process, verification is expedited by the fact that the components of the M&S have been previously examined to ensure conformance to sound software-engineering techniques. Validation is enhanced because the standards have already been reviewed by subject matter experts and senior analysts to ensure the standard in question is a valid representation of its real world counterparts. All approved standards will be documented thus providing both V&V and Accreditation agents information on the utility and limitations of a standard. In short, by using approved standards, V&V and Accreditation become less time consuming and expensive.

THE ARMY'S SEVEN STEP STANDARDS DEVELOMENT PROCESS

The Army's development of M&S standards is consensus-based by choice. M&S technologies evolve at blinding speeds. Some technological niches turn over in a matter of months. Technological, procedural, and application advances take place within a myriad of organizations in the Army, and throughout the government, commercial and academic sectors. Attempting to centralize the authority for establishing standards, without devoting major resources to the effort, would not enable the Army to remain a M&S community leader. Rather, it could place the Army permanently behind the rest of the M&S community. No single Army office or organization is capable of effectively investigating and making the necessary decisions to evolve Army models and simulations that keep pace with the rest of the industry. By keeping the process consensus-based, those decisions are in the hands of the real Army M&S experts.

<u>Build Teams</u>. Subject matter experts from various organizations throughout the Army are appointed to serve as Standards Category Coordinators (SCCs). They are not executive agents. They serve as the leadership for developing M&S standards within their individual category. They are empowered to develop their teams by drawing on the mix of talents and expertise needed in their specific area. Team composition is

interdisciplinary and knows no organizational boundaries. Membership is based on inclusion rather than exclusion. Each team has an electronic mail reflector, which permits a wider community to participate in the development of future standards while minimizing travel.

Define Requirements. The second step is to define requirements. To assist in this and the next three steps the Army has developed the Standards Nomination and Approval Process (SNAP) at http://www.msrr.army.mil/snap. At the heart of SNAP is the Standards Requirement Document (SRD). The SRD, an on-line form, is the first step in developing a new Army M&S standard; refining an existing standard; or nominating an accepted M&S procedure, practice, process, technique, algorithm, or heuristic to become a standard. With only limited resources to devote to the development of standards, it is essential to keep the work of the team focused on the most important issues. Once an SRD is received, the Army Model and Simulation Office (AMSO) coordinates validation of the proposed requirement with the appropriate SCC, the Army's three M&S domain representatives (Advanced Concepts and Requirements; Research, Development, and Acquisition; and Training, Exercises, and Military Operations), and other key players to ensure that the proposal supports a community need. After validation is completed, the initiator is provided feedback. A proposed standard could be an excellent idea but may fail to fit a "market niche". If the proposal is approved, it then moves on to the next step in the process.

Develop Standards. This step is the crux of the Army's M&S Standards Development Process. The wider the involvement of experts across the M&S community, the more likely each team will capture, adapt, or develop those procedures, processes, techniques, algorithms, and heuristics – as well as "best and current practices" – that warrant becoming an Army M&S standards.

Achieve Consensus. After the standard has been developed, the next step is to achieve consensus. SNAP is the primary vehicle used by the teams to "hammer-out" issues and achieve consensus on a draft standard. SNAP monitors all electronic mail traffic on the reflectors and as part of its database maintains a copy of every reflected message sent. This useful feature allows one to review the on going debate on one or more draft standards, enter the debate at any time during the process, and eliminates the need for team members to personally maintain a copy of every electronic mail message. Each draft standard may go through several iterations before being embraced by the team. Because the process is continuous and iterative, the community more readily adopts standards they feel can be modified and improved over time.

Obtain Approval. Once consensus has been achieved, a panel of Senior M&S subject matter experts then reviews the draft standard. SNAP automatically sends an electronic mail message to the appropriate reviewers. The message contains a "hot-link" to their individual voting page along with information on the draft standard. Senior reviewers may either vote "Yes" or "No". If they vote "No" a comment field must be completed or the vote will not be accepted. Every effort will be made to resolve the senior reviewer's concerns prior to the closure of voting. After voting has concluded the proposed standard

and all comments are either forwarded to the Deputy Under Secretary of the Army (Operations Research) (DUSA(OR)) for approval or returned to the standards category team for additional work.

Promulgate Standards. Every approved Army M&S standard will be registered in the Army Standards Repository System (ASTARS) at http://www.msrr.army.mil/astars. For each entry, you will find information about the standard and a point-of-contact. To the maximum extent practical standards will be made available electronically. Standards in ASTARS can be password-protected when access needs to be limited. However, classified standards will not be stored in the current version of ASTARS. Those standards not available for public release will follow the release procedures for M&S described in Army Regulation 5-11. Each SCC has a Home Page to provide specific information pertaining to their category. Information on all the aspects of M&S Standards can also be accessed from both the AMSO Home Page (http://www.amso.army.mil) and the Army Node of the Modeling and Simulation Resource Repository (MSRR) (http://www.msrr.army.mil).

Educate. Educating and assisting modelers and users is accomplished concurrently with the other steps. Once a standard has been approved, the team begins educating the M&S community on the availability, applicability, and use of the standard. The more active the standards category team, the more educated the community.

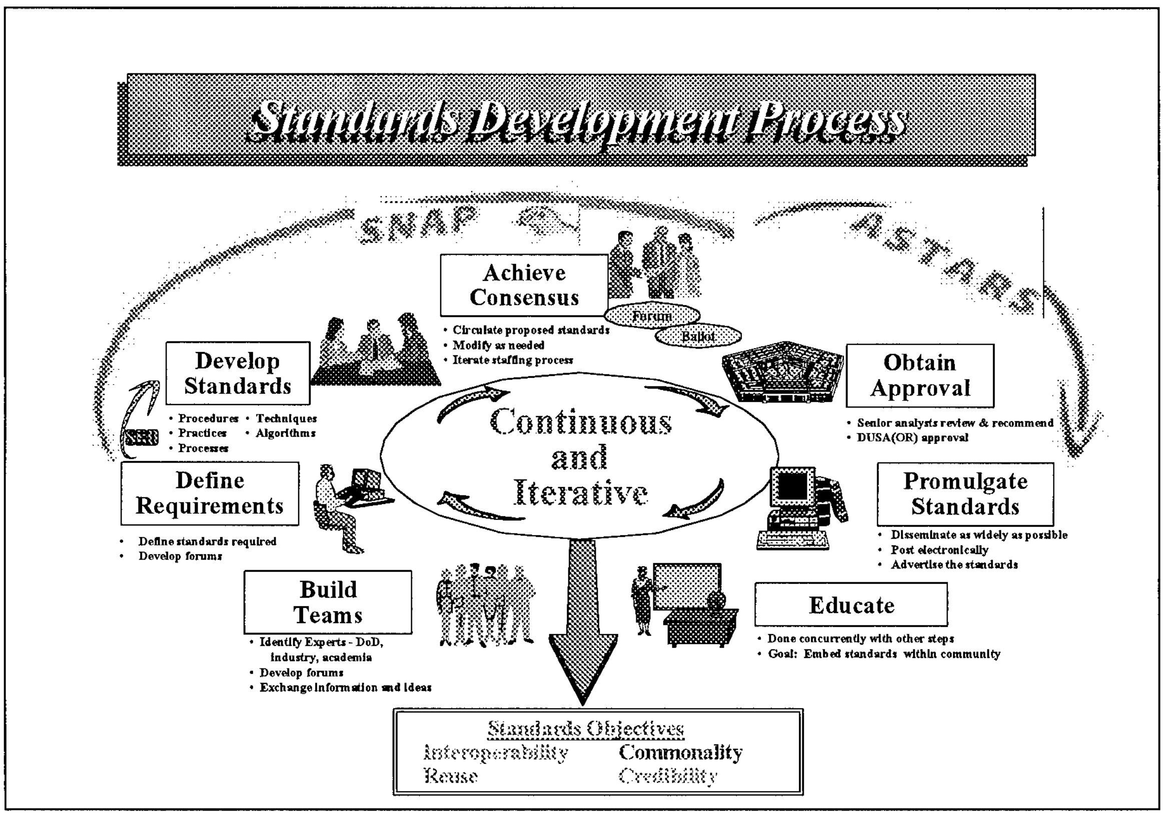

FIGURE 3. The Army's M&S Standards Development Process

SNAP

The Standards Nomination and Approval Process (SNAP; http://www.msrr.army.mil/snap) is the tool that facilitates executing four steps of the Army M&S Standards Development Process: 1) define requirements, 2) develop standards, 3) achieve consensus, and 4) obtain approval. From the beginning of its development, in May 1997, SNAP was fully integrated into the Army's seven step M&S Standards Development Process.

At the heart of SNAP is the Standards Requirement Document (SRD). The SRD, an on-line form, is the first step in developing a new Army M&S standard; refining an existing standard; or nominating an accepted M&S practice, procedure, or technique to become a standard. The overall SRD format is consistent with the M&S Requirements Document so it can easily be integrated into the Army M&S Requirements Integration and Approval Process if necessary.

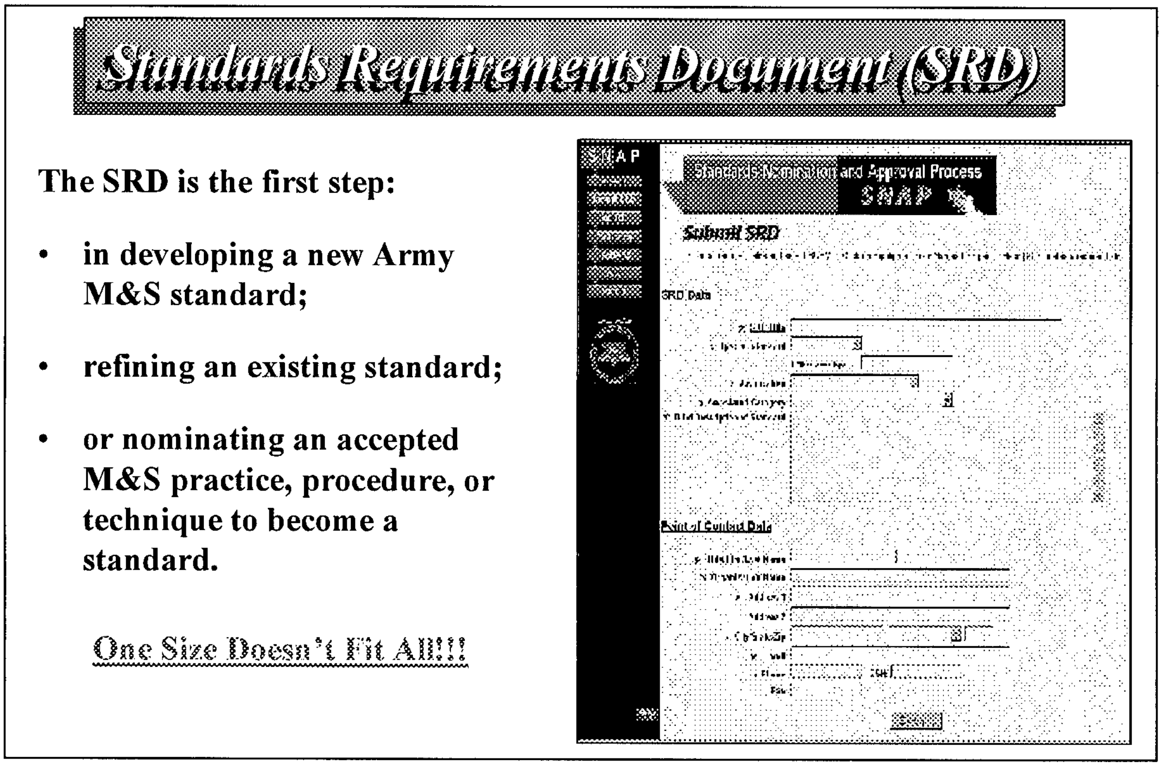

FIGURE 4. The Standards Requirements Document

To assist AMSO, SCCs, and interested parties in the tracking of a draft standard, SNAP has both a browse and a search capability. Browse allows a user to see a list of all in process and approved standards sorted in ascending SRD number. Additionally, while in Browse, a user can elect to change how draft standards are displayed, specifically by sorting them by SRD Number, Current SRD Status (All, In Process, or Approved), or Standards Category.

SNAP also has a built-in search engine which, when selected, brings up its Fast Find / Search page. This page is divided horizontally into two sections. The Fast Find section offers a user the ability to find an in process or approved standard by its' SRD Number and the first 60 characters of its title. The Search section contains a query dialog box containing AND / OR logic fields and input fields that enable the user to conduct a more thorough search.

Also part of SNAP, is an electronic mail reflector that echoes all messages to all current subscribers. Thus, by sending a message to a reflector, all subscribers receive a copy even though the message wasn't addressed to each of them directly.

Each Standards Category has a reflector and they are used extensively in the Army M&S Standards Approval Process as a forum to develop and achieve consensus on draft standards. SNAP monitors this traffic and – as part of its database – maintains a copy of every reflector message sent. For those who have just joined a Standards Category, or for old hands, this feature allows one to review the on going debate on one or more draft standards and eliminates the need for current subscribers to maintain a copy of every reflector message sent. This unique feature permits individuals to enter the debate at any time during the define requirements, develop standards, or achieve consensus steps. SNAP also uses its reflectors to notify current subscribers of a given standards category when a draft standard is being developed or is being voted upon.

When a SCC has determined that consensus has been achieved on a draft standard, they can recommend to AMSO that the standard be forwarded to that category's Senior Reviewers for voting. If approved by AMSO, SNAP will automatically send an electronic mail message to each appropriate Senior Reviewer. This message will contain a "hot-link" to that Senior Reviewer's voting page along with information on the draft standard. Provided they have Internet access, the Senior Reviewer can select the "hot link" and move directly to their voting page. Senior Reviewers may either vote "Yes" or "No". When they vote "No" a comment field must be completed or the vote will not be accepted. If the comment field is completed, an electronic message is automatically sent to both AMSO and the appropriate SCC. Every effort will be made to resolve the Senior Reviewer's concerns prior to the closure of voting.

ASTARS

For each standard in the Army Standards Repository System (ASTARS; http://www.msrr.army.mil/astars), you will find information about the standard and a point-of-contact. To the maximum extent practical, all of the items described in ASTARS will be available to the public for download or linked to another web site where the standard is available for download. Standards in ASTARS can be password-protected when access needs to be limited. However, classified standards will not be stored in

ASTARS. Those standards not available for public release will follow the release procedures for M&S described in Army Regulation 5-11.

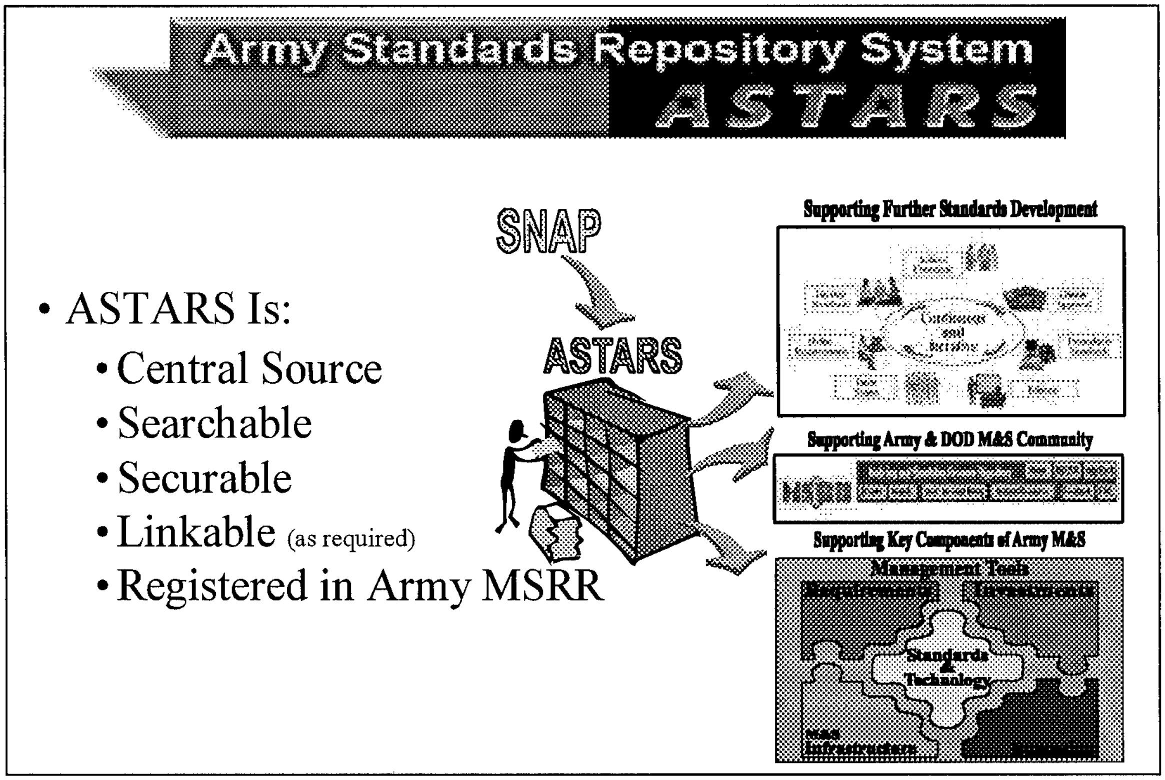

FIGURE 5. The Army Standards Repository System

When first entering ASTARS, a user has three ways to find the standard that they are interested in: View All, Browse, or Search. By selecting View All, the user is given a list of all standards, tools, and documents housed in ASTARS, regardless of their associated category. The standards title, a brief description, the category, and submission date are provided. By selecting Browse, the user is taken to ASTARS' Browse page. Here the user may select a specific Standards Category to look in. Again, a list of all standards associated with that category is listed. By selecting Search, the user is taken to ASTARS' Search Documents page. Here all of the standards, tools, and documents in ASTARS can be searched by title, description, keywords, submitter, file name (e.g., standard.doc or algorithm.ppt), or file type (i.e., .doc, .xls, or .ppt). But regardless of how a user locates a standard in ASTARS, to obtain further information or – provided that access to it is not limited – download the standard the user selects simply selects the document's title.

THE ARMY M&S STANDARDS WORKSHOP

The annual AMSO-sponsored M&S Standards Workshop for SCCs and their teams serves as a key opportunity for the identification, definition, exploration, and resolution of standards issues. It is important to develop standards in a timely manner to support major simulation acquisition programs and to minimize the use of proprietary or contractor-unique approaches. It is equally important to identify and adopt products from major simulation programs for incorporation into future M&S. At the workshop each category team updates their category roadmap and evaluates draft AMIP projects according to their roadmap.

This process involves serious thought and insight into the needs and requirements for current and future Army M&S. New issues and topics requiring attention and discussion are uncovered. The workshop format allows team members from different categories to interact and determine the best way to address new issues, as well as strengthen current topics.

At the conclusion of the workshop, the SCCs provide a briefing that highlights their standards development efforts; e.g., their Roadmaps, updated definitions and requirements; and draft AMIP project nominations. This allows attendees to comment on the project nominations. Based on feedback from the audience, comprised of the P&T WG, other SCCs, and team members, the SCCs will be able to incorporate useful information into their project proposals.

The workshop for FY99 will be held at the Army Center for Strategic Leadership, Collins Hall, Carlisle Barracks, PA, from 3 - 6 May. Updated information concerning the workshop can be obtained from the AMSO website (http://www.amso.army.mil).

APPENDIX A

Key Personnel and Information

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STANDARDS CATEGORY COORDINATORS

CATEGORY	NAME	ADDRESS	PHONE
Acquire	Dave Dixon	TRADOC Analysis Center – WSMR ATTN: ATRC-WB (Mr. Dixon) White Sands Missile Range, NM 88002-5502	V: (505) 678-4510 DSN: 258-4510 F: (505) 678-5104
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Attrition	Alan Dinsmore	Director, AMSAA ATTN: AMXSY-CD (Mr. Alan Dinsmore) 392 Hopkins Road Aberdeen Proving Ground, MD 21005 5071	V: (410) 278-2785 DSN: 298-2785 F: (410) 278-6585
C4I Integration	MAJ Michael J. Staver	TPIO-SE NSC 410 Kearney Avenue Ft. Leavenworth, KS 66027-1306	V: (913) 684-6502 DSN: 552-6502 F: (913) 684-8227
Communication Systems	Burt Kunkel	Commander, USA Signal Center & Fort Gordon ATTN: DCD, CAD, M&S Br (Mr. Kunkel) Fort Gordon, GA 30905-5090	(706) 791-1977 DSN: 780-1977 F (706) 791-6595
Command Decision Modeling	Sean MacKinnon	National Simulation Center ATTN: ATZL-NSC-D 410 Kearny Avenue Fort Leavenworth, KS 66027-2345	(913) 684-8290 DSN: 552-8290 F (913) 684-8299
Cost Representation	Steve Pawlow	Director, USA Cost & Economic Analysis Center ATTN: SFFM-CA-PA (Mr. Pawlow) Rm 327, Nassif Building 5611 Columbia Pike Falls Church, VA 22041-5050	(703) 681-3347 DSN 761-3347 F (703) 681-7553

STANDARDS CATEGORY COORDINATORS

CATEGORY	NAME	ADDRESS	PHONE
Data	Pete Rigano	Director, AMSAA ATTN: AMXSY-J (Mr. Rigano) 392 Hopkins Road Aberdeen Proving Ground, MD 21005-5071	(410) 278-4005 DSN 298-4005 F (410) 278-6632
Deployment/ Redeployment	Melvin Sutton	Director, MTMC, Transportation Engineering Agency ATTN: MTTE-SIT (Mr. Sutton) 720 Thimble Shoals Blvd. Suite 130 Newport News, VA 23606	V: (757) 599-1638 DSN: 927-1638 F: (757) 599-1564
Dynamic Atmospheric Environments	Rick Shirkey	Director, US Army Research Laboratory ATTN: AMSRL-IS-EW (Dr. Shirkey) White Sands Missile, NM 88002-5501	V: (505) 678-5470 DSN: 258-5470 F: (505) 678-4449
Functional Description of the Battlespace	MAJ Frank Rhinesmith	PM-ADS ATTN: AMCPM-FAMSIM (MAJ Rhinesmith) USA STRICOM 12350 Research Parkway Orlando, FL 32826	(407) 384-3634 DSN: 970-3634 F: (407) 384-3640
Logistics	Ron Fischer	USA CASCOM ATTN: ATCL-CAT Fort Lee, VA 23801-6000	V: (804) 734-0682 DSN: 539-0322 F: (804) 734-3640
Mobilization	Julie Allison	Director, USA CAA ATTN: CSCA-MP (Ms. Allison) 8120 Woodmont Ave. Bethesda, MD 20814-2797	(301) 295-1588 DSN 295-1588 F (301) 295-5110
Move	Niki Deliman	Director, USAE Waterways Experiment Station ATTN: CEWES-GM-K (Dr. Deliman) 3909 Halls Ferry Road Vicksburg, MS 39181-6199	(601) 634-3369 F (601) 634-2764

Appendix A

STANDARDS CATEGORY COORDINATORS

CATEGORY	NAME	ADDRESS	PHONE
Object Management	Brad Bradley	Director, AMSAA ATTN: AMXSY-CS (Mr. Bradley) 392 Hopkins Road Aberdeen Proving Grounds, MD 21005-5071	V: (410) 278-4066 DSN: 298-4066 F (410) 278-6585
Semi-Automated Forces	Pam Blechinger	TRADOC Analysis Center ATTN: ATRC-FM (Ms. Blechinger) 255 Sedgewick Ave Fort Leavenworth, KS 66027-2345	V: (415) 751-8855 F: (408) 656-3084
Terrain	James "Ken" Barnette	US Army Topographic Engineering Center ATTN: CETEC-TP (Mr. Barnette) 7701 Telegraph Road Alexandria, VA 22315	V: (703) 428-6502 DSN 328-6502 F: (703) 428-6656
Visualization	TBD	Commander, USA STRICOM ATTN: AMSTI 12350 Research Park Way Orlando, FL 32826-3276	V: (407) DSN: 970- F: (407)
VV&A	Larry Cantwell	TRADOC Analysis Center ATTN: Mr. Cantwell 255 Sedgewick Ave. BLDG. 314 Fort Leavenworth, KS 66027-1306	V: (913) 684-9224 DSN: 552-9224 F: (913) 684-9151
Questions or Issues related to the Standards Process, AMIP, and the SCCs can be directed to the following:			
AMSO POC	Richard Maruyama	Director, Army Model and Simulation Office ATTN: DAMO-ZS (Mr. Maruyama) 400 Army Pentagon Washington, DC 20310-0400	V: (703) 601-0013 ext 26 DSN: 329-0012 ext 26 F: (703) 601-0018

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STANDARDS CATEGORY E-MAIL REFLECTORS

Standards Category	SCC	E
Acquire	Dave Dixon	amso-scc-ac
Architecture	Wesley Micks	amso-scc-ar
Attrition	Alan Dinsmore	amso-scc-at
C4I Integration	MAJ Mike Staver	TBD
Communication Systems	Burt Kunkel	amso-scc-c3
Command Decision Modeling	Sean MacKinnon	amso-scc-cd
Cost Representation	Sean Pawlow	amso-scc-co
Data	Pete Rigano	amso-scc-da
Deployment/Redeployment	Melvin Sutton	amso-scc-de
Dynamic Atmospheric & Environments	Dr. Richard Shirkey	amso-scc-dy
Functional Description of the Battlespace	MAJ Frank Rhinesmith	amso-scc-fd
Logistics	Ron Fischer	amso-scc-lo
Mobilization	Julie Allison	amso-scc-m
Move	Niki Deliman	amso-scc-m
Object Management	Brad Bradley	amso-scc-ob
Semi-Automated Forces	Pam Blechinger	amso-scc-sa
Terrain	James Barnette	amso-scc-te
Visualization	TBD	amso-scc-vi
Verification, Validation and Accreditation	Larry Cantwell	amso-scc-vv
Administrative	Richard Maruyama	amso-scc-ad

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SNAP/ASTARS URLs

	URL Addres
Standard Nomination & Appraisal Process (SNAP)	http://www.msrr.army.mil/snap
Army Standards Repository System (ASTARS)	http://www.msrr.army.mil/astars

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POLICY AND TECHNOLOGY WORKING GROUP

ORGANIZATION	CONTACT NAME/ADDRESS	PHONE/FAX NUMBERS	
AMSO -WG Chair	Director, Army Model and Simulation Office ATTN: DAMO-ZS (Mr. Maruyama) 400 Army Pentagon Washington, DC 20310-0400	V: (703) 601-0012/13 ext 26 DSN: 329-0012/13 ext 26 F: (703) 601-0018	ma
ADO	Army Digitization Office ATTN: DACS-ADO (Ms. Wright) 400 Army, Pentagon Washington, DC 20310	V: (703) 693-3910 DSN : 223-3910 F: (703) 693-4100	wri
AMC	Commander, US Army Materiel Command ATTN: AMCRDA-TL (Mr. Welker) 5001 Eisenhower Ave Alexandria, VA 22333-001	V: (703) 617-5426 DSN 767-5426 F: (703) 617-2554 DSN 767-2554	kw
ARI	Commander US Army Research Institute for the Behavioral and Social Sciences ATTN: PERI-II (Dr. Gillis) 12350 Research Parkway Orlando, FL 32826	V: (407) 384-3985 DSN: 970-3985 F: (407) 384-3999 DSN: 970-3999	gill
ARNG	Chief, National Guard Bureau ATTN: NGB-ARO-TS (MAJ Harber) 111 South George Mason Drive Arlingon, VA 22204-1382	V: (703) 607-7316 DSN: 327-7316 F: (703) 607-7383/7385 DSN: 327-7383/7385	har
AWC	Commandant US Army War College ATTN: AWCC-DSL-ST (COL Slattery) Carlisle Barracks Carlisle, PA 17013-5050	V: (717) 245-3171 DSN: 242-3171 F: (717) 245-4600 DSN: 242-4600	slat
CAA	Director US Army Concepts Analysis Agency ATTN: CSCA-OS (Mr. Cooper) 8120 Woodmont Avenue Bethesda, MD 20814-2797	V: (301) 295-0529 DSN: 295-0529 F: (301) 295-5114 DSN: 295-5114	coo

ORGANIZATION	CONTACT NAME/ADDRESS	PHONE/FAX NUMBERS	
CEAC	Director, US Army Cost and Economic Analysis Center ATTN: SFFM-CA-PA (Mr. Pawlow) 5611 Columbia Pike Falls Church, VA 22041-5050	V: (703) 681-3347 DSN: 761-3347 F: (703) 756-7553	pay
FORSCOM	Commander US Army Forces Command ATTN: AFOP-PLA (LTC Lewis) Ft McPherson, GA 30330-6000	V: (404) 464-6360 DSN: 367-6360 F: (407) 464-5523 DSN: 367-5523	lew
MTMC	Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) ATTN: MTTE-SIT (Mr. Sutton) 720 Thimble Shoals Boulevard, Suite 130 Newport News, VA 23606	V: (757) 599-1638 DSN: 927-1638 F: (757) 599-1564	sut
OASA(RDA)	Assistant Secretary of the Army For Research, Development, and Acquisition ATTN: SARD-DO (Ms. Purdy) 2511 Jefferson Davis Highway Arlington, VA 22202-3911	V: (703) 604-7006 DSN: 664-7006 F: (703) 604-8177 DSN: 664-8177	pur
OCAR	Chief of Army Reserves ATTN: DAAR-PAE (CPT Litzenberg) 2400 Army Pentagon Washington, DC 20310-2400	V: (703) 601-0939 DSN: 329-0939 F: (703) 601-0929	litz
ODCSINT	Deputy Chief of Staff for Intelligence ATTN: DAMI-IFT (Ms. Macklin) Rm 9302, Presidential Tower 211 Jefferson Davis Highway Arlington, VA 22202	V: (703) 604-2454 DSN: 664-2454 F: (703) 601-0553 DSN: 329-0381/0547	ma
ODCSLOG	Commander US Army Logistics Integration Agency ATTN: LOSA-CD (Mr. Rybacki) 54 M Avenue, Suite 4 New Cumberland, PA 17070-5007	V: (717) 770-6001 DSN: 977-6001 F: (717) 770-6702	ryb

POLICY AND TECHNOLOGY WORKING GROUP

ORGANIZATION	CONTACT NAME/ADDRESS	PHONE/FAX NUMBERS	
ODCSOPS	Deputy Chief of Staff for Operations and Plans ATTN: DAMO-ZD (MAJ Simpson) Rm 3A538, The Pentagon Washington, DC 20310-0400	V: (703) 695-4807 DSN: 225-4807 F: (703) 614-9044 DSN: 224-9044	sim
ODCSPER	Deputy Chief of Staff for Personnel ATTN: DAPE-MR (Dr. Holz) Rm 2C733, The Pentagon Washington, DC 20310	V: (703) 697-1608 DSN: 227-1608 F: (703) 697-1238 DSN: 227-1238	hol
ODISC4	Director, Information Systems for Command, Control, Communications, & Computers ATTN: SAIS-PAA-S (LTC Cromwell) Rm 1C634, The Pentagon Washington, DC 20310	V: (703) 695-4553 DSN: 225-4553 F: (703) 695-5213 DSN: 225-5213	cro
OPTEC	Commander US Army Operational Test and Evaluation Command ATTN: CSTE-OM (Ms. Wilson) 4501 Ford Avenue Alexandria, VA 22302-1458	V: (703) 681-6685 DSN: 761-6685 F: (703) 681-6914	wil
PA&E	Department of the Army Office of the Chief of Staff ATTN: DACS-DPR (LTC Generazio) 200 Army Pentagon Washington, DC 20310-0200	V: (703) 693-0506/0510 DSN: 223-0506 F: (703) 697-8723 DSN: 227-8723	gen
SMDC	Commander US Army Space and Missile Defense Command ATTN: CSSD-BL-S (Mr. Street) P.O. BOX 1500 Huntsville, AL 35807	V: (205) 955-3921 DSN: 645-3921 F: (205) 955-1354	stre
TRADOC	Commander, DCSSA US Army Training and Doctrine Command ATTN: ATAN-SM (Ms. Winter) Fort Monroe, VA 23651-5000	V: (757) 728-5832 DSN: 680-5832 F: (757) 728-4394 DSN: 680-4394	wir

POLICY AND TECHNOLOGY WORKING GROUP

ORGANIZATION	CONTACT NAME/ADDRESS	PHONE/FAX NUMBERS	
USACE	Commander, Hqrts, US Army Corps of Engineers Director of Research and Development ATTN: CERD-M-ZD (Mr. Lundien) 20 Massachusetts Avenue, NW Washington, DC 20314-1000	V: (202) 761-1847/0752 DSN: 763-1847/0259 F: (202) 761-0907	jen
USAREUR	Commander-in-Chief US Army Europe and 7th Army ATTN: AEAGC-TS-F (LTC Lee) Unit: 28130 APO AE 09114	V: 011-49-9641-83-2460 DSN : 474 F: 011-49-9641-83-2541	lee
USARPAC	Commander, HQ US Army, Pacific ATTN: APOP-PL (Mr. Deryke) Fort Shafter, HI 96858-5100	V: (808) 438-2498 DSN: 315-2498 F: (808) 438-4940	der
Questions or Issues related to the AMSMP WG and the SIMTECH Program can be directed to the following			
MS4D Manager	Director, Army Model and Simulation Office ATTN: DAMO-ZS (LTC Timian) The Pentagon, Army 400 Washington, DC 20310-0400	V: (703) 601-0012/13 ext. 32 DSN: 329-0012/13 ext. 32 F: (703) 601-0018	tim

APPENDIX B

Standards Category Definitions and Requirements

Categories	**Page**

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AREAS OF SPECIAL INTEREST DEFINITIONS AND COORDINATORS

Categories	Definitions	Requir
Acquire	Encompasses those algorithms which model the phenomena pertaining to the firsthand collection of battlefield information by an observer/sensor. In general four quantities or processes are addressed in this Standard Category: (1) Signatures of the battlefield environment, including signatures of both the datum of interest and the surrounding environment; (2) Signature transmission/transformation from source to receptor; (3) Discrimination of target/datum of interest from background; and (4) The search process performed in the examination of the battlefield. Applicable to signatures in the acoustic and electromagnetic (ultraviolet, visible, infrared, and radar) spectra with either reflective or emissive sources. Countermeasures to acquisition (signature reduction, reduced signature transmission, or degraded discrimination capability) are also applicable.	• Develop standard representations of tl transmission, discrimination, and sea simulations • Develop standard techniques for impl representations into combat models ai • Assure integration of standard catego perception models into combat model • Assure that anticipated changes in rej requirements for category products ar categories
Architecture	The structure of components in a program/system, their relationships and principles and guidelines governing their design and evolution over time. Architecture includes the system framework and components that facilitate interoperability of all types of models and simulations, as well as facilitate reuse of M&S components. It encompasses virtual, constructive, and live simulations from ACR, RDA and TEMO domains.	• Develop, demonstrate, and prom protocols, interfaces, processes and n • Transition current standardization ef efforts to be in compliance with the e specifically the DoD M&S High Leve • Develop an awareness of evolving ar Virtual Reality Machine Language (V Network (DWN)
Attrition	Addresses the algorithms and processes that encompass the selection, prioritization and engagement of targets and the subsequent battle damage assessment and disengagement of combatant forces. Also included within this framework are physical processes that represent the probabilities of hit/kill for both direct and indirect fire weapon systems, effects of countermeasures, tracking and designation of targets, flyout of projectiles (including line-of-sight checks as appropriate), ammunition expenditure, and battle damage assessment.	• Establish standard attrition methodo • Facilitate use of standard attrition m • Improve known weaknesses • Investigate the adequacy of current n deficient

Categories	Definitions	Requir
C4I Integration	The process that develops hardware, software and procedural standards to provide a seamless vision of the battlespace on C4I systems and surrogates by incorporating and integrating the environment, entitles and their psychologies across virtual, constructive and live simulations. This enables leaders, decision makers, staffs and soldiers at all levels to attain cognitive awareness of the battlespace.	• Define and achievable set candidate current JTA-Army C4I and M&S Dc • Determine C4I requirements for Ten Systems, Data, Dynamic Environme • Define and articulate attainable, ada according to Technical Reference M • Prototype standards prior to impleme
Command Decision Modeling (CDM)	Procedure, practices, processes, techniques, data, and algorithms that model or simulate human behavior that results in apperception being formed, a decision being made, an action or reaction, or a plan being formulated.	• Develop a collective requirement doc expectations • Examine mission-planning applicati • Explore representation of the individ
Communication Systems	Encompasses the objects, algorithms, and techniques necessary to replicate friendly and enemy control, communications, and computer systems and processes.	• Define and design objective systems • Coordinate common systems represe • Upgrade current M&S capabilities tc • Insure design will permit systems int constructive and virtual worlds • Insure HLA compliance is part of th communications models • Provide for data interchange of allow combat models • Develop MOEs to identify key eleme communications, and computer M& • Insure the models are available to us
Cost Representation	Addresses Army standard cost definition and the data, tools, algorithms, and techniques for preparing and portraying cost and economic analyses for military operations, acquisitions, and modeling and simulation activities.	• Develop, document, and promote Ar algorithms, and techniques necessar and portray cost and economic analy and modeling and simulation activiti • Standardize techniques for comparin • Update the Army's principal publica guidance • Manage Army cost analysis initiativ Acquisition • Interface with other Army M&S stan

AREAS OF SPECIAL INTEREST DEFINITIONS AND COORDINATORS

Categories	Definitions	Requir
Data	Procedures that increase information sharing effectiveness by establishing standardization of data elements, data base construction, accessibility procedures, data maintenance and control.	• Promote Data Standards • Develop infrastructure • Data modeling tools and training • Standardize data structures • Automate existing databases • Develop new databases • Expand Education
Deployment/ Redeployment	Addresses objects, algorithms, data, and processes needed to accurately portray the relocation of military and civilian forces from the origin to the area of operations, and the preparation for and movement of forces from one are of operations to follow-on designated CONUS or OCONUS bases or areas of operation.	• Develop modeling standards that adc TEMO, RD&A, execution, planning end-to-end process element • Develop a common object structure f deployment/transportation, includin supplies), transportation assets, carg • Develop and document deployment r algorithms, and processes at various • Ensure commonality and linkages w simulations
Dynamic Atmospheric Environments	Those objects, algorithms, data, and techniques required to replicate weather, weather effects, and impacts, backgrounds, acoustic and transport and dispersion of aerosols and battle by-products in models and simulations.	• Provide fundamental environmental • Provide consistent data for environm • Provide standardized database for sy • Provide set of standard synthetic nat
Functional Description of the Battlespace	The process and the information products that describe Army functions, validated by the user, and stored in a standard way for the use and consistent understanding of simulation developers.	• Develop standard information templ simulation developer • Develop a process that captures valic of the behaviors, components, and cl • Develop policy and procedures for m and algorithms for simulation develc knowledge warehouse for current an • Establish liaisons between major Ar Standard Categories to encourage us • Standardize a front end analysis met development • Explore methods of gathering, shari and algorithms for building new mo establishing standards for reuse on f

Categories	Definitions	Requir
Logistics	Objects, algorithms, data, and processes which model or simulate the initial provisioning, supply, resupply, stockage, facilities, maintenance and sparing of the ten classes of supply and CSS services provided to and in the field. Army standardization requirements must address M&S support for CSS functions to and in the field	Develop standards to support M&S for th functions (in priority order): 1. Class III (Bulk POL) 9. 2. Class V (Ammo) 10. 3. Class VII (Major End Items) 4. Class IX (Repair Parts) 11. 5. Personnel 12. 6. Class I (Food and water) 13. 7. Maintenance 14. 8. Medical
Mobilization/ Demobilization	Includes the algorithms, objects, and unique modeling techniques needed to accurately portray preparation of forces for military operations and their return, to include: active units, reserve units, active duty individuals, mobilization of Reserve Component (RC) individuals, expansion of CONUS/OCONUS installation support facilities, preparation for overseas movement, and surge and expansion of the industrial base.	• Standardize algorithms, objects, and • Provide linkage of mobilization mod databases • Ensure commonality with strategic d algorithms
Move	Encompasses the objects, algorithms, data, and techniques necessary to replicate activities that influence land force platform/ unit and personnel movement (ground, air, and water). It also addresses mobility and countermobility as engineer functions, suppression (as a mobility degrader), formations, and dispersion.	• Land force platform and personnel n • Mobility and countermobility as engi • Suppression effects on movement • Dispersion and formations
Object Management	The process that develops abstract object classes that are: (1) consistent in their representation of object attributes/methods; (2) applicable to 95% of the M&S employing them; (3) accepted by the M&S community; and (4) interoperable at levels allowed by their model environment.	• Develop definitions of abstract objec • Develop policy and procedures for m • Form liaisons between major Army s categories to encourage use, updates, • Explore methods for gathering, shari
Semi-Automated Forces (SAF)	Software integration which produces realistic entities in synthetic environments which interface appropriately with live, constructive, virtual and simulator entities, but which are generated , controlled and directed by computer routines.	• Develop SAF standards that are usef distributed simulations, representati in a joint environment • Minimize operator overhead for SAF • Ensure structures and data bases are

AREAS OF SPECIAL INTEREST DEFINITIONS AND COORDINATORS

Categories	Definitions	Requir
		• Provide consistent representations fo tactical/doctrinal behaviors in all SA • Support the development of the High
Terrain	Includes the objects, algorithms, data, and techniques required to represent terrain and dynamic terrain processes in modeling and simulation.	• Defining geospatial information cont requirements for developmental mod • Determine standards for correlated te • Determine standards for rapid terrai • Determine standards for dynamic ter • Determine a consensus based data ex • Encourage use of reuse repositories (• Coordinate with other categories clos
Verification, Validation & Accreditation (VV&A)	Verification is the process of determining if the M&S accurately represent the developer's conceptual description and specifications and meets the needs stated in the requirements document. Validation is the process of determining the extent to which the M&S adequately represents the real-world from the perspective of its intended use. This process ranges from single modules to the entire system. Accreditation is an official determination that the M&S are acceptable for its intended purpose.	• Establish and define standard verific processes • Build verification and validation tool • Make the above tools available to use • Develop measures of effectiveness to validation tolerances
Visualization	The representation of a physical environment which includes representation of combatants (vehicles, aircraft, personnel, ships, etc) in a dynamic environment. (Includes the concept of virtual and constructive entities in a live environment).	

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APPENDIX C

Area of Special Interest Definitions and Points of Contact

Categories	Page

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AREA OF SPECIAL INTEREST DEFINITIONS AND COORDINATION

Area of Special Interest	Definitions	Coord
Operations Other Than War (OOTW)	OOTW involve military forces and resources where the primary mechanism for mission accomplishment is not necessarily lethality. Civilian involvement in OOTW includes private individuals, agencies of the U.S. Government, non-governmental organizations, foreign governments, transnational organizations, and others. Execution of OOTW missions often place the greatest burden on limited active component combat service support.	**COL Pat Slattery** **Commandant, U.S. Army V** **ATTN: AWC-AW (COL S** **Carlisle Barracks** **Carlisle, PA 17013-5050** **Comm: (717) 245-3171; DS** **Fax: (717) 245-4600** **E-mail: slatterp@csl-emh1**
Information Operations (IO)	Encompasses algorithms to both generate IO tasks and to register their effects on communications, sensors, situational awareness (perceived ground truth database are represented in various models), and command decision making. Also includes standards for implementing human-in-the-loop workarounds (primarily for the TEMO domain) for aspects of IO that may not be appropriate for closed form modeling.	**Mr. John Armeau** **Land Information Warfare** **ATTN: Mr. Armeau** **5111 Leesburg Pike** **Falls Church, VA 22042-32** **Comm: (703) 681-4354; DS** **Fax: (703) 681-3437** **E-mail: liwa@erols.com**
Weapons of Mass Destruction (WMD)	Encompasses the representation of weapons that are capable of a high order of destruction and/or of being used to destroy a large number of people, in Army modeling and simulation. WMD can be nuclear, biological, chemical, and radiological weapons, but the term excludes the means of transporting or propelling the weapon where such a means is a separable and divisible part of the weapon.	**COL Jay Stobbs** **Director Nuclear Division, I** **ATTTN: ATNA-NU (COL** **7150 Heller Loop** **Springfield, VA 22150-319** **Comm: (703) 806-7860** **Fax: (703) 681-7900** **E-mail: stobbs@usanca-sm**
Emulation and Stimulation	Software and hardware federations that: 1) provide a seamless, synthetic battlefield environment in support of live testing and training to faithfully represent assets that are not available or too costly to employ; 2) stimulate systems or operational units with realistic combat loading in order to overcome environmental and / or safety limitations; and 3) support schoolhouse training.	**Mr. Ed Sowell** **Commander, TEXCOM** **ATTN: CSTE-TEX-MA (N** **Ft Hood, TX 76544-5068** **Comm: (254) 288-1845; DS** **Fax: (254) 288-1844** **E-mail: sowelledward@tex**

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APPENDIX D

Standard Category Coordinators' Annual Reports

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Annual Standards Category Report for FY99

ACQUIRE

STANDARDS CATEGORY DEFINITION

The Acquire Standard Category encompasses those algorithms which model the phenomena pertaining to the firsthand collection of battlefield information by an observer/sensor. In general four quantities or processes are addressed in this Standard Category:

1. Signatures of the battlefield environment, including signatures of both the datum of interest and the surrounding environment.
2. Signature transmission/transformation from source to receptor.
3. Discrimination of target/datum of interest from background.
4. The search process performed in the examination of the battlefield.

The acquire standard category is applicable to signatures in the acoustic and electromagnetic (ultraviolet, visible, infrared, and radar) spectra with either reflective or emissive sources. Countermeasures to acquisition (signature reduction, reduced signature transmission, or degraded discrimination capability) are also applicable.

STANDARDS REQUIREMENTS

This standards category involves objects, algorithms, data, and techniques which represent battlefield information collection. Standardization objectives include:

1. Developing standard representations of the four acquire processes (signature, transmission, discrimination, search) required by combat simulations and models.
2. Developing standard techniques for implementing the acquire process representations into combat models and simulations.
3. Assuring integration of standard category acquire products with the other standard categories.
4. Assuring that anticipated changes in representation capabilities and requirements for category products are communicated to the other standards categories.

The crucial areas for acquisition model development fall in the areas pertaining to human-in-the-loop acquisition performance. Both the constructive simulation and virtual simulation environments have acquisition performance data and algorithms in common, therefore work on these topics has wide application and a corresponding high return on investment.

ACCOMPLISHMENTS AND ASSESSMENT

Acquire

The DELPHI vision model project started its first phase in (FY97). This was a project to extract and calibrate to US acquisition criteria, the nonproprietary acquisition algorithms of the BAE ORACLE vision model. The nonproprietary algorithms which duplicate the performance of the original ORACLE of the cone midget channel (stationary target/jovial vision) algorithms was completed in Phase 1 during FY97. Also several data sets were identified for the calibration process. These data sources include stationary and moving targets; unaided eye and magnified optics; field-of-view and field-of-regard search; high and low light levels; and target detection, recognition, and identification. The second phase of the project to develop a nonproprietary version of the cone diffuse (moving target/peripheral vision) algorithms has been completed. Calibration of the channels (midget and diffuse) with the identified data sets is underway. As part of the DELPHI project a draft System Object Module (SOM) for Delphi has been prepared. The draft SOM and is being forwarded to the SC Object Management for consideration as a draft prototype for a sensor object. Funding for the last tasks of the DELPHI project was delivered in the 4th Quarter FY98, because of the late funding the final product a standard model for visual target acquisition and a draft standard is currently expected to be completed late in the 4th Quarter FY99.

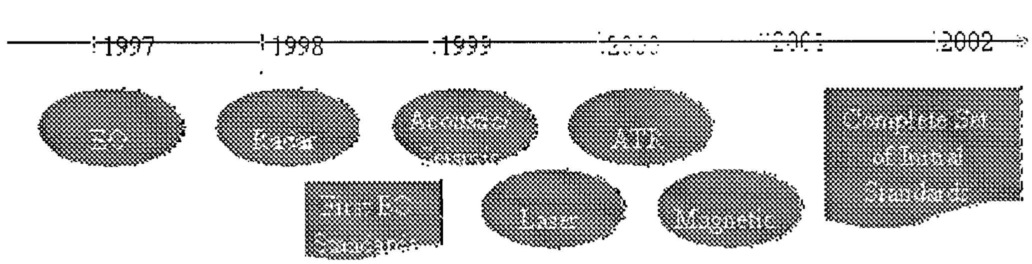
Category Acquire submitted two draft requirements and standards to SNAP in June, **NVESD ACQUIRE** and **EOSAEL COMBIC**.

Draft standard algorithms for visual target contrast propagation, perception misidentification and a standard methodology for discrimination algorithm integration into combat simulations are in work but not ready for submision to SNAP and ASTARS.

ROADMAP

Process:

Roadmap:



The road map for ACQUIRE remains largely unchanged:

1. The initial set of standards for optical and electro-optic (EO) sensors are about 75% complete. With the addition of a misidentification algorithm for EO sensors, initial standards for EO sensors will be complete. The completion of the DELPHI vision model project, the optical contrast model project and a misidentification algorithm for optical sensors will complete a set of initial standard algorithms for optical sensors for each of the ACQUIRE processes.

2. The next phase of standards development, the initial standards development for acoustic and radar work is just beginning. This work will require the identification or development of suitable models representing the ACQUIRE processes for acoustic and radar sensors, the preparation of standards for each model. The acoustic and radar areas are the priority focus areas for the working group during FY99.

   The prioritization of submissions in the Acquire category is focused on the identification and development of an initial set of standards. The prioritization of other work in the category remains the same as previous years with human acquisition performance modeling as the focus. Priorities for submissions for FY99 have been assigned based on the following rationales:

   1. Projects developing standard models of the search and target acquisition processes for inclusion in the initial set of ACQUIRE standards should be given first priority for funding. An initial set of standards for the four basic acquisition processes will help promote uniform and efficient implementation of search and target acquisition algorithms across Army M&S.

   2. Second priority for funding should fall to discrimination and search modeling research, these are the least robustly modeled topics in the ACQUIRE category. The current soft state of modeling in these areas has implication for the utility and fidelity of engineering, constructive, and virtual simulations.

Based on these criteria Standard Category Acquire is submitting two category Acquire proposals and one joint proposal with standard category Dynamic Atmospheric Environments. The Acquire first priority proposal is a new project titled "Acoustic Modeling for Army Studies". Many proposed combat systems include an integrated suite of sensors covering different portions of the spectrum. Army force-on-force models have focused on visual, mid-infrared (IR), far-IR and some radar performance and acoustic sensors have been largely ignored. With the onset of systems such as the Wide Area Mine (WAM), Remote Sentry System, Integrated Acoustic Sensor, and the Future Scout and Cavalry System (FSCS), the analytical community will require suitable models for acoustic acquisition and the implementation methodologies for the models. The Acquire second priority proposal is titled

Acquire

"Radar and Contrast Model Identification and Standard Development" There are several models currently at a mature level of development that could be adopted as U.S. Army standards. These models address the areas of visual and thermal contrast modeling, and elements of radar systems.

The joint proposal with standard category Dynamic Atmospheric Environments is "Light Scattering for Wargames and Target Acquisition (LSWTA)". Three existing light scattering models, all developed by ARL/BE, currently exist. One in TRAC's CASTFOREM, one in MICOM's Battlefield Environment Weapon System Simulation (BEWSS), and a in-house research grade code. Standard category of Acquire has requested a standard code. To accomplish this CASTFOREM's and BEWSS's legacy models will be compared with the research grade code. A new model will be developed by extracting relevant portions from the legacy models and incorporating these with improvements determined from the research grade code and advances in the literature.

Annual Standards Category Report for FY99
ARCHITECTURE

This report provides a status of architecture standardization efforts, including identification of significant progress made during the past year and standardization priorities for FY99.

STANDARDS CATEGORY DEFINITION

The following definition of Architecture, from the DoD Modeling and Simulation Master Plan, is proposed:

Architecture is the structure of components in a program/system, their relationships, and principles and guidelines governing their design and evolution over time. Architecture includes the system framework and components that facilitate interoperability of all types of models and simulations, as well as facilitate reuse of M&S components. It encompasses virtual, constructive, and live simulations from the Advanced Concepts and Requirements (ACR), Research, Development and Acquisition (RDA), and Training, Exercise and Military Operations (TEMO) domains.

STANDARDIZATION REQUIREMENTS

The proposed Army standardization requirements for architecture are:

a. Develop, demonstrate, and promote common components, standards, protocols, interfaces, processes and methodologies.

b. Transition current standardization efforts and all new standards development efforts to be in compliance with the emerging joint technical architecture and specifically the DoD M&S High Level Architecture (HLA).

c. Develop an awareness of evolving architectures, including, but not limited to Virtual Reality Machine Language (VRML), network technologies, and the Dismounted Warrior Network (DWN).

ACCOMPLISHMENTS AND ASSESSMENT

For each of the architecture standardization requirements the following accomplishments were made during FY98. The assessment of these projects is that the Army and DoD are adequately funding technology related to architecture so that standards can be developed.

1. Development, demonstration, and promotion of common components, standards, protocols, interfaces, processes and methodologies.

- IEEE Standards Activity. Two HLA Standards have been nominated for IEEE standardization: the HLA Interface Specification V1.3 and the Object Model Template (OMT) Specification V1.3. Standards development groups have actively met to resolve comments to the proposed standards in preparation for IEEE balloting.

- SISO. The Simulation Interoperability Standards Organization (SISO), which evolved from the DIS Standards organization, has made a commitment to develop standards that apply across multiple classes of simulations by incorporating the HLA and affiliated standards, and hence to support the full range of DoD simulation needs.

- SIW. The Simulation Interoperability Workshop (SIW) supports the entire Modeling and Simulation (M&S) community by embracing the DoD High Level Architecture. Historically, the workshop evolved from the DIS Workshop; however, the scope of the workshop now encompasses a broader range of simulation issues and communities, including DoD as well as other government and non-government applications. Participants include simulation developers, simulation users, and operations analysts, from various government, industry and academic communities. Two SIW workshops took place during the past fiscal year, focusing on HLA.

- RTI. DMSO sponsors the Runtime Infrastructure (RTI) software development during the HLA evolution period in an effort to ensure the technical feasibility of development of RTI software, to provide a common use implementation which is freely available across the DoD and industry, and to provide a base for HLA technical experimentation. The development will be accomplished in two phases. RTI v1.0 is a government-developed baseline RTI build. RTI v2.0 is under development by industry, and was based on a open competitive design process. The architecture of the RTI is regularly briefed at the SIW and at the Architecture Management Group (AMG) meetings.

2. Transition current standardization efforts and all new standards development efforts to be in compliance with the emerging joint technical architecture and specifically the DoD High Level Architecture (HLA).

- The Joint Technical Architecture-Army, Version 5.0 (formerly the Army Technical Architecture) was approved by SAIS-PAA via memorandum on 11 September 97. Specific migration planning guidance and procedures are available at http://www.ado.army.mil.

- The High Level Architecture was approved by USD(A&T) via memorandum on 6 September 96. Specific policy, guidance, and supporting software are available at http://www.dmso.mil.

3. Develop awareness of evolving architectures, including but not limited to WARSIM, JSIMS, OneSAF, and Virtual Reality Machine Language (VRML).

The WARSIM/JSIMS software architecture has evolved to a baseline version for support of the Initial Operational Capability (IOC) system. The architecture is a multi-layered architecture with several frameworks. The frameworks create common interfaces while allowing the other elements of the architecture to be developed and evolved separately. The four principal elements of the architecture are a model repository, a set of simulation support tools, a collection of physical and behavioral models, and the interface to external systems. Although a specific approach has not been finalized, the architecture will support composability, scalability, and multi-resolution modeling.

OneSAF is in the early stages of their architectural analysis. Initial efforts are focused on assessment of existing CGF architectures (CCTT-SAF and MODSAF) and the development of software use cases to support risk reduction.

STATUS OF FY97 AMIP FUNDED PROJECT

The High Level Architecture (HLA) Object Model Template (OMT) is a specification for documenting HLA-relevant information about classes of simulation or federation objects and their attributes and interaction which provides "after-the-fact" documentation of simulation capabilities. The intent of the proposed project is to develop extensions to the HLA OMT that would enable its use as a method for simulation specification and design. The goal is that the OMT could also be used "before-the-fact" during the simulation specification and design process. In the first phase of the project current simulation specification mechanisms would be studied and adapted as a set of extensions to the OMT. In the second phase OMT extensions would be revised based on a prototype application of them to a new simulation and also feedback from the modeling and simulation community. The contract was funded during 3rd quarter FY98. The HLA OMT format is under study to determine accessible documentation on simulation specification methods.

PRIORITIES FOR NEXT YEAR

The Architecture Standards Category Team met at the Army M&S Standards Workshop on 4-7 May 1998. At the workshop, the team redefined the architecture requirements to include the need to develop an awareness of evolving architectures such as VRML. The team also revised the list of architecture shortfalls from FY98, based on the Architecture.

ROADMAP

A. HLA Evolution Period. The HLA will continue to be refined by the Architecture Management Group (AMG). DMSO will be responsible for configuration management, technical assistance, and related activities as DoD programs incorporate the HLA.

Additional HLA draft specifications will be nominated as standards to the SAC. The specifications will address compliance testing, time management, data management and data distribution management, security , and other applicable areas. Development, prototyping, experimentation, and user support with the RTI will continue. Study groups are frequently established to focus on specific issues related to the HLA. Their products are available at http://siso.sc.ist.ucf.edu.

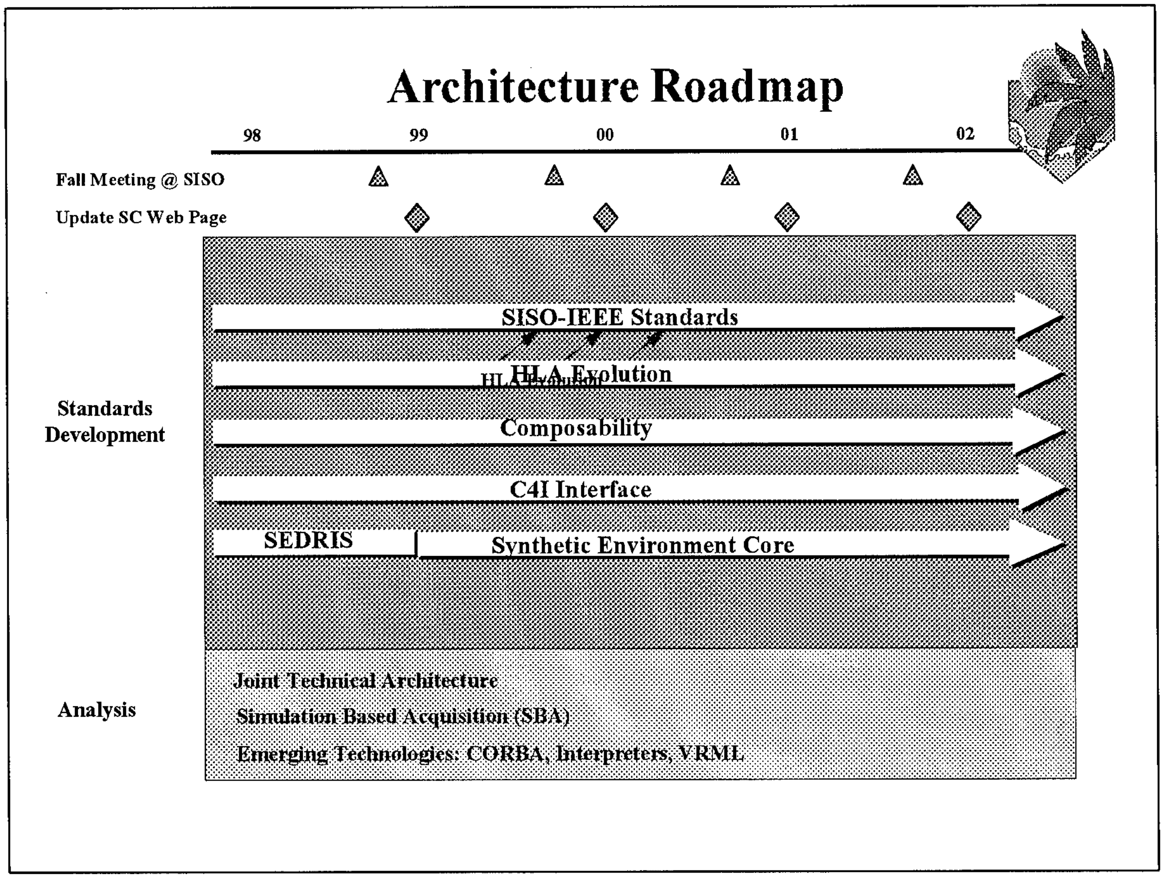
B. Composability. A derived definition of modeling and simulation composability is the ability to create, configure, initialize, test, and validate an exercise by logically assembling a unique simulation execution from a pool of reusable elements in order to meet a specific set of objectives. Programs such as JSIMS, WARSIM, and OneSAF are studying the feasibility and issues associated with composing simulation systems to meet their individual objectives.

C. C4I Interface. STRICOM has recently appointed a program manager for the standardization of C4I Simulation Systems. The PM C4ISS holds monthly information exchange meetings to facilitate horizontal integration of technology across the C4I community.

D. SEDRIS. The Synthetic Environment Data Representation and Interchange Specification (SEDRIS) is intended to articulate and capture the complete set of data elements and associated relationships needed to fully represent a synthetic environment used as the basis for training or gaming. The definition of the Data Model is expected to support the full range of simulation applications (e.g., computer generated forces, manned, visual and sensor systems) across all environmental domains (terrain, ocean, atmosphere, space). In addition to providing a standardized representation method, SEDRIS will provide a standard interchange mechanism to pre-distribute environmental data and facilitate interoperability among heterogeneous simulations. This community-wide interchange mechanism will support the reuse of synthetic environment databases between disparate simulation systems.

ROADMAP

The Architecture Roadmap extends from FY98 to FY02.



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Annual Standards Category Report for FY99

ATTRITION

STANDARDS CATEGORY DEFINITION

The Attrition Standards Category addresses the algorithms and processes that encompass the selection, prioritization, and engagement of targets and the subsequent battle damage assessment and disengagement of combatant forces. Also included within this framework are physical processes that represent the probabilities of hit/kill for both direct and indirect fire weapon systems, effects of countermeasures, tracking and designation of targets, flyout of projectiles (including line-of-sight checks as appropriate), and ammunition expenditure.

STANDARDIZATION REQUIREMENTS

The standardization objectives of the Attrition category include the following:

- Establish standard attrition methodologies for both high and low resolution modeling,
- Facilitate use of standard attrition methodologies by the M&S community,
- Improve known weaknesses, and
- Investigate the adequacy of current methodologies and replace where deficient.

ACCOMPLISHMENTS AND ASSESSMENT

The primary focus of the Attrition Category during the past year has been to support simulation developments in the Army – namely, the Joint Warfare System (JWARS) and Warfighters' Simulation (WARSIM) 2000 models. The use of standard algorithms has been strongly encouraged, while modifications to those standards have been generated and provided to model developers as required for particular application needs.

The Attrition Standards category was requested by the DCSOPS Technical Advisor to provide recommendations regarding ground warfare attrition approaches to support JWARS model development. In response, Attrition Category members reviewed the available documentation on the JWARS requirements relating to attrition and investigated the methods currently being used within the Army to model aggregate attrition to determine how well these approaches, or variations of them, would meet JWARS' needs. The review process included participation in several JWARS Ground Users Working Group meetings to obtain insights into overall model design and the critical constraints, such as run time requirements. Another important part of the process was a multi-agency attrition methodology review convened in January 1998 by the Attrition Category to develop a strawman attrition modeling approach which later became the basis for an Army recommendation on the subject.

Attrition

After extensive coordination with senior analysts and subject matter experts from TRAC, CAA, Rand Corporation, ARL, and AMSAA, the Category recommendations were briefed in March 1998 to the DCSOPS Technical Advisor and representatives from the JWARS Program Office and AMSO, who gave their unanimous approval. Since that time, Category members have been closely working with the JWARS Program Office to facilitate the implementation of the recommended direct fire aggregate attrition and weapon allocation algorithms into JWARS. This coordination is expected to continue into next year as indirect fire and other attrition methodologies are implemented into the model.

Another of the Category initiatives involved providing recommendations to the WARSIM 2000 model developers on an aggregate attrition approach to meet the training needs of division/corps commanders and staff. Candidate methodologies (derivatives of approaches being used in JWARS and the Close Combat Tactical Trainer Semi-Automated Forces model) were developed and reviewed and the associated strengths and weaknesses were identified. Category members closely coordinated with STRICOM, NSC, WARSIM PM Office and the contractor developers to provide guidance and counsel on current standard methodologies (including several potential modifications designed to better match model needs) and their applicability to WARSIM 2000 requirements. In addition, coordination with the Move Category Coordinator and, to a much lesser degree, with the Acquire Category Coordinator was accomplished to support WARSIM methodology development in the mobility and target acquisition functional areas. It is expected that this type of methodology support and coordination across standards categories will continue throughout the next few years as the model moves toward IOC.

As the Standards Nomination and Approval Process (SNAP) and the Army Standards Repository System (ASTARS) were being developed, Attrition Category members participated as part of the group which conducted beta testing for the two systems. Suggestions and comments were provided to AMSO and resulted in several capabilities being improved. A chapter from the Compendium of High Resolution Attrition Algorithms (published by the Attrition Category in October 1996) dealing with direct fire attrition was submitted to SNAP and later to ASTARS. This was done to more formally adopt the algorithms contained in the Compendium as standards in a reasonably organized manner, grouped by the types of engagements occurring on the battlefield. As SNAP and ASTARS evolve, other Compendium chapters will be submitted until the entire document has been included on both systems.

The AMSO-sponsored Army Modeling and Simulation (M&S) Workshop held at Carlisle Barracks, PA during 4-7 May 1998 provided an excellent opportunity to review the ongoing attrition-related activities in the Army and share with the Workshop attendees the status of the Attrition Category efforts. Category members discussed the priorities for future standards work, developed a revised roadmap for Category activities, and reviewed and further developed several proposals for FY99 AMIP funding consideration. In addition,

there was significant interaction and cooperation with other standards category coordinators, particularly in terms of support to JWARS and WARSIM 200 model development.

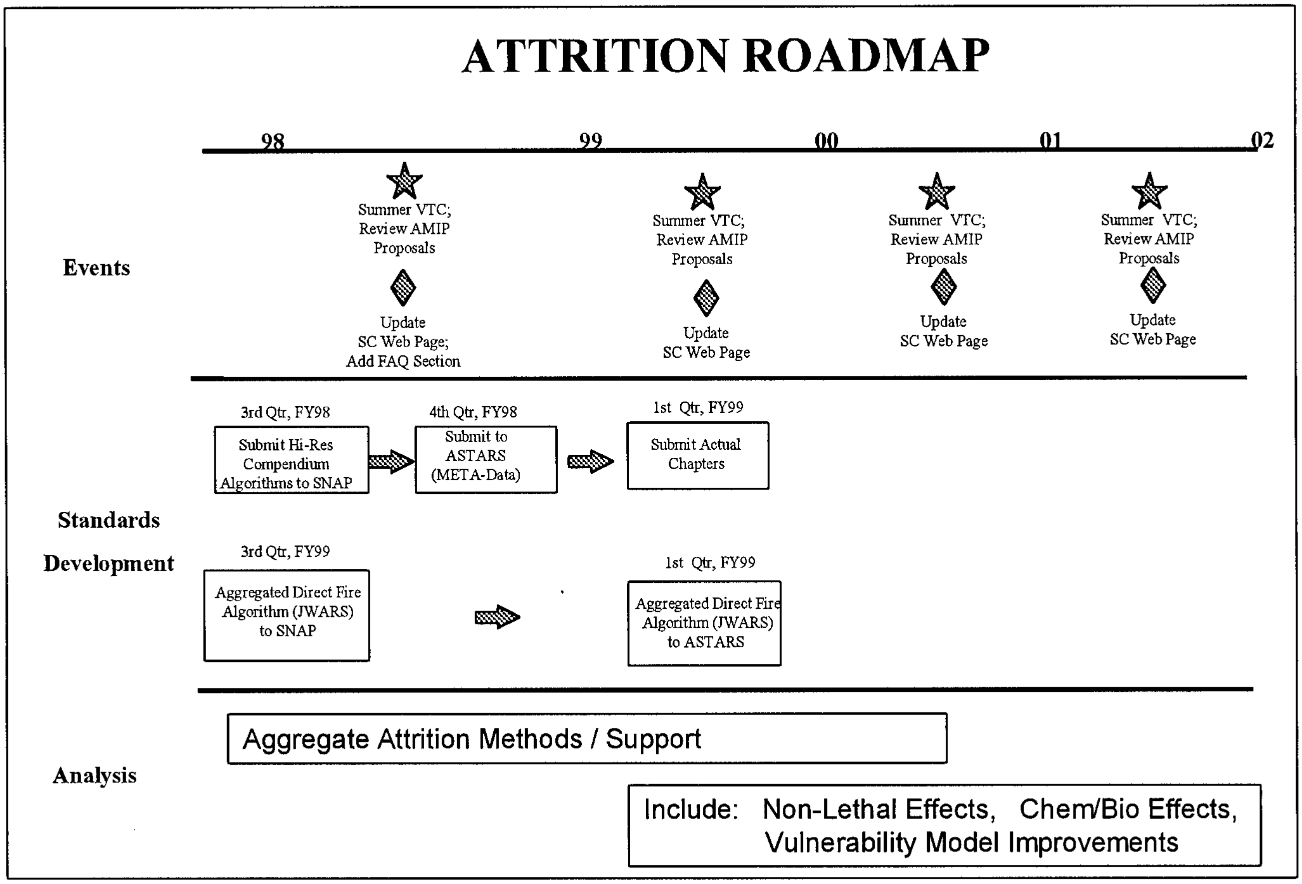
PRIORITIES FOR NEXT YEAR

As the SNAP and ASTARS tools become further refined, the Attrition Standards Category plans to submit the remainder of the algorithms in the Compendium of High Resolution Attrition Algorithms to those web-based systems. These algorithms will be provided by chapter as they are included in the Compendium. For the aggregate level of resolution, the attrition methodology being implemented into the JWARS model will be submitted to SNAP for consideration as a standard. These actions should help to formalize these methodologies as attrition standards and promote their use throughout the M&S community.

Another top priority for next year will be the development of the Compendium of Aggregate Attrition Algorithms, which will document the attrition methodologies currently being used in division, corps, and theater level Army models. This effort is dependent on AMIP funding decisions, but with monetary support, a first draft and initial review could be completed by the end of FY99, with the final document available by mid FY00.

Support to the JWARS and WARSIM 2000 models will be a significant effort within the Category during FY99 as prototypes are developed and tested. The inclusion of methods to address the other attrition areas beyond direct fire engagements will soon become the attrition focus for these models. As in the past year, the implementation of standard approaches will be stressed, with modifications recommended as dictated by specific model requirements.

Other efforts within the category will include investigating methodologies and developing standard approaches in the areas of disengagement criteria, vulnerability model improvements, and non-lethal effects.


ATTRITION ROADMAP
98
99
00
01
02
Events
Summer VTC; Review AMIP Proposals
Update SC Web Page; Add FAQ Section
Summer VTC; Review AMIP Proposals
Update SC Web Page
Summer VTC; Review AMIP Proposals
Update SC Web Page
Summer VTC; Review AMIP Proposals
Update SC Web Page
Standards Development
3rd Qtr, FY98
Submit Hi-Res Compendium Algorithms to SNAP
4th Qtr, FY98
Submit to ASTARS (META-Data)
1st Qtr, FY99
Submit Actual Chapters
3rd Qtr, FY99
Aggregated Direct Fire Algorithm (JWARS) to SNAP
1st Qtr, FY99
Aggregated Direct Fire Algorithm (JWARS) to ASTARS
Analysis
Aggregate Attrition Methods / Support
Include: Non-Lethal Effects, Chem/Bio Effects, Vulnerability Model Improvements

Annual Standards Category Report for FY99

COMMAND, CONTROL, COMMUNICATION COMPUTERS & INTELLIGENCE (C4I) INTEGRATION

STANDARDS CATEGORY DEFINITION

The process that develops hardware, software and procedural standards to provide a seamless vision of the battlespace on C4I systems and surrogates by incorporating and integrating the environment, entities and their psychologies across virtual, constructive and live simulations. This enables leaders, decision makers, staffs and soldiers at all levels to attain cognitive awareness of the battlespace.

STANDARDIZATION REQUIREMENTS

C4I Integration embraces graphical user interfaces (GUIs), icon attributes, the military decision making process, cognitive processes, databases, and fielding plans. Models and simulations contain intrinsic GUIs, enable analysis to develop visualization tools, and stimulate C4I. Establishing standards ensures software and hardware are interoperable and synchronized across domains using germane technology. Standards make potentially diverse and complex requirements manageable for the researcher by providing focus. Standards inform the developer of guidelines he must meet beforehand thus preventing redesign. Lastly, analysts, trainers, and warfighters benefit from habitual association to things they see, hear, feel, and smell when using synthetic environments. C4I Integration requirements summarized:

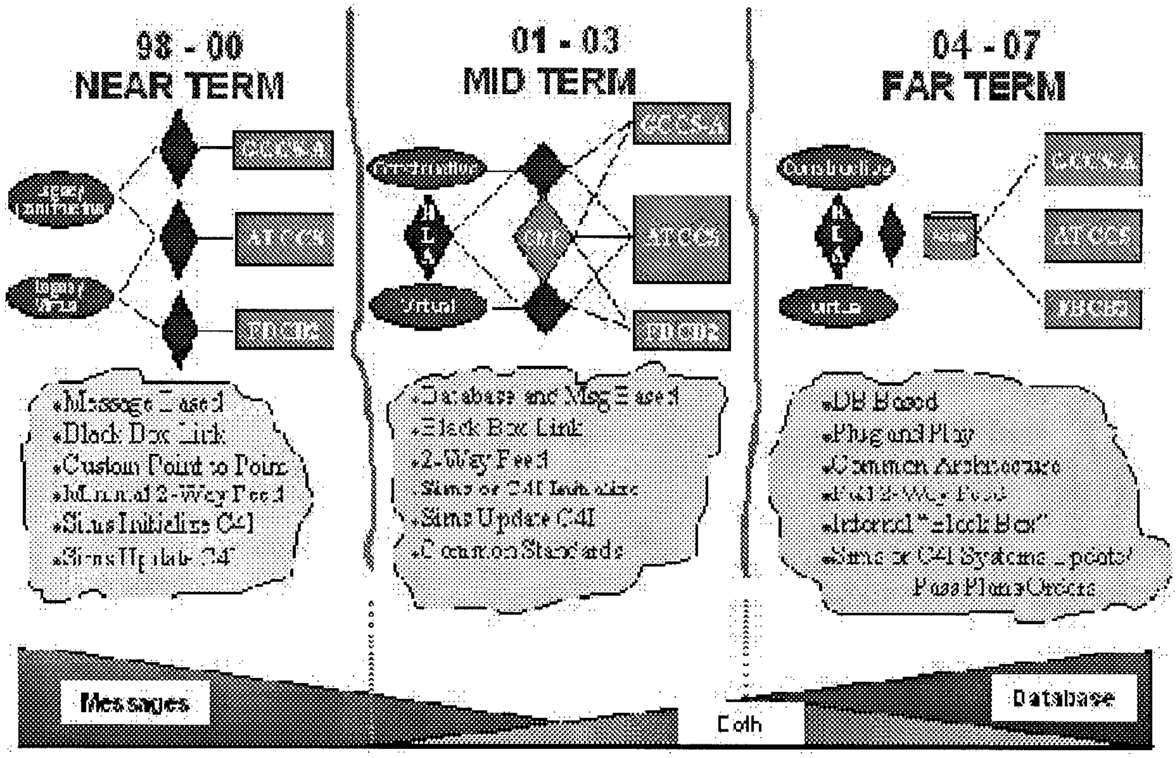
1. Define an achievable set of candidate standards that are consistent with the current JTA-Army C4I and M&S Domain Architectures.
2. Determine C4I requirements for Terrain, Object Management, CDM, C3 Systems,
3. Data, Dynamic Environment, and FDB SCCs.
4. Define and articulate attainable, adaptable, and scalable standards according to
5. Technical Reference Model for C4I M&S Interfaces.
6. Prototype standards prior to implementation.

Both models and simulations, and C4I ultimately must portray situational information for decision makers. C4I Integration is the means and ways to visualization which is the ends. Currently, visualization has deferred sensory stimulation efforts to the C4I community which has numerous high dollar efforts for battlefield visualization. These efforts focus on the art and science of presenting visual and other sensory information to warfighters for digital situational awareness, planning, and sensor to shooter. The C4I Integration category focus is to forge common standards for not only the M&S community, but also the C4I community. Standards developed will not only promote reuse and interoperability, but also steer developers to engineering software designed to support simulation stimulation.

ACCOMPLISHMENTS AND ASSESSMENT

After the first full year as a category, the C4I Integration Team has grown to include not only ACR, RDA, TEMO and TPIO-ABCS, but also representatives from the C4I development community. DISC4, CECOM, PEOC3S, ADO, CTSF, and numerous PMs have participated in Visualization activities. Besides building a robust team, C4I Integration Standards Category is poised to submit comprehensive standards that, for the first time formalize, procedures for engineering interoperability between analytical, acquisition, and training constructive and virtual M&S and experimental and operational C4I systems. Developers, testers, experimenters, and trainers all agree that common methodologies implemented through standards are needed to produce a near seamless environment consisting of M&S and C4I systems. Simulation Based Acquisition (SBA) tenants emphasize that first, C4I systems rely on the synthetic environment for concepts, experiments, acquisition, and training evidence the Division Advanced Warfighting Experiment and MCS IOT&E which used CBS stimulating live TOCs with Army Battle Command Systems (ABCS). SBA for ABCS has indicated that from ABCS concept to retirement, simulations interfaced to C4I is essential to accelerating digital technology development in the information age, and ideally, interfaces bought for testing and experimentation can then be used for sustainment training to reduce interface costs. The other important tenant is that simulations require SBA. Simulations must now not only provide a synthetic environment, but also stimulate or emulate the digital battlefield. Therefore, M&S must be engineered in concert with the development of the C4I they ultimately must stimulate/emulate. Lastly, active warfighter, trainer, tester, and analyst involvement is needed early in development and proto-typing of simulations and C4I interfaces. Army Modeling Improvement Project Architecture Alignment addressed how to better synchronize standards development between the M&S and C4I communities. This effort culminated in a paper presentation at the Fall Software Interoperability Workshop titled "The Army's Approach to Modeling and Simulation Standards for C4I Interfaces."

ROADMAP



The C4I Integration Roadmap characterizes the technical milestones for integrating models and simulation, C4I, and for integrating the synthetic environment with digitized battlefield. Current legacy systems lack common standards for interoperability and reuse. Integration is currently
characterized by:

- Message translation of formats that vary by echelon and battlefield functional area.
- Custom black box linkage that must continually be modified end to end to support M&S application software.
- Minimal 2-way feeds from C4I systems to M&S. Only AFATDS inputs orders to the synthetic environment in place of the workstation.
- Analog production of databases that mirror M&S to C4I that is both costly and time consuming. Once database continuity is established, M&S initialize C4I systems providing location. Analog procedures are then used to provide C4I systems unit status and disposition.
- During runtime, the simulation stimulates C4I systems with friendly and enemy location, and in some cases, unit status.

C4I systems and M&S currently under development are required to comply with Joint

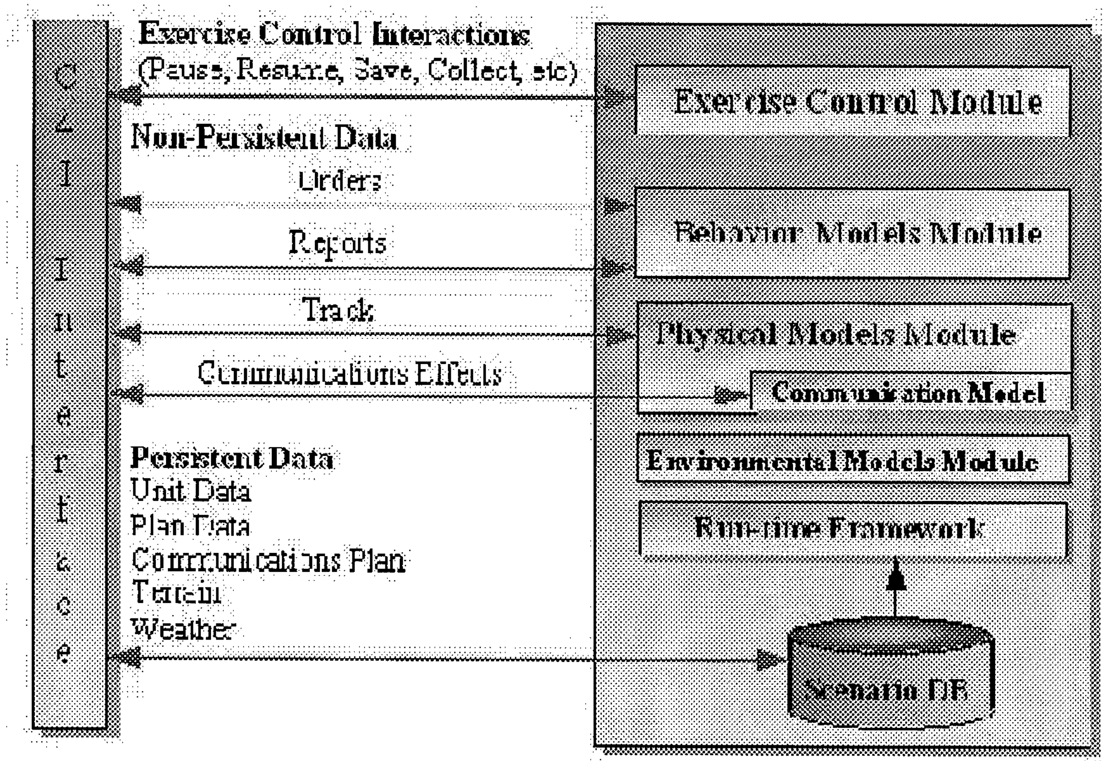
Technical Architecture(JTA). For M&S, the JTA standard is the High Level Architecture (HLA), and for C4I, the standard is the DIICOE. In the mid term, integration is characterized by:

- C4I systems beginning to use distributed databases to reduce message traffic and bandwidth requirements.
- Black box linkage that includes not only middle-wear interfaces but also the C4I COE Message Parser (CMP) which could serve as a single point of entry for stimulation.
- 2-way interactions capitalizing on intelligent agents in M&S that enable C4I systems to more fully serve as synthetic environment workstations to do exercise control, after action review, and data sharing versus mirroring.
- Initialization by C4I systems to further reduces scenario and database development overhead. This also enables course of action analysis and rehearsals by downloading persistent information such as task organization, STARTEX disposition, and equipment.
- Simulations continue to update C4I with dynamic position and strength information.
- Standards common to M&S and C4I enable interfaces to exchange less application data and more common data reducing data exchange volume and types. Common standards continue to allow freedom of action for M&S and C4I systems.

The far term forecast for C4I systems is to exploit the synthetic environment capabilities in the information age:

- Database exchange among and between C4I and M&S will nearly eliminate message traffic.
- Common standards will lead to a common architecture at the operational, systems, and technical levels for ACR, RDA, and TEMO.
- Full 2-way interaction including speech recognition and fully interactive battlefield visualization tools will make C4I systems indistinguishable from the synthetic environment.
- Interfaces with common standards will persist continuing to bridge the live environment from the synthetic environment, however, there will no longer be separate black boxes, rather imbedded software either in C4I or M&S.

PRIORITIES FOR FUTURE WORK



C4I Interface Reference Model

The first priority to build common standards for M&S and C4I that enable data exchange without costly and timely integration efforts. Data Interchange Formats (DIFs) create the conditions for developers to forward engineer interface capabilities rather than do post engineering after M&S or C4I systems are developed. In FY99, the C4I Integration Team will produce DIFs for interfacing M&S to C4I. The data passed between M&S and C4I is extensive so a "divide and conquer" approach is being taken that classify in the C4I Interface Model shown above. Exercise Control is defined as that data that must be exchanged to Start, Stop, Resume, Restore to an earlier state, manage time, manipulate ground truth, and collect data for AAR and analysis. Non-Persistent data is defined as data that presents the dynamic status of the synthetic or live environment such as task organization, orders, reports, tracks, and effects. Persistent data is defined as that information that is static or nearly static such as MTOE, OPLAN, equipment characteristics, terrain, and weather. Persistent data is associated with the database build process and non-persistent is germane to stimulation and emulation. DIFs touch several categories, namely Data, Communications Systems, Terrain, Architecture, and Dynamic Atmospheric Environment, and require close coordination with

the respective SCCs. The next priority is to further extend technical integration by adapting the HLA and Defense Information Infrastructure Common Operating Environment (DIICOE) to exploit the capabilities of information technology. A Technical Reference Federation Object Model (FOM) is needed in the HLA for C4I integration. Proto-typing new methodologies concurrent to developing DIFs is also a high priority. Research in this area will indicate changes necessary internal to M&S or C4I to further engineer interoperability and extensibility. For example, C4I systems now only operate in real time, however for COAA and rehearsal, it is necessary to run faster or slower than real time or do time step as M&S does. If research shows this is in fact needed, the DIICOE must be modified. By conducting this research with the C4I system proponents and engineers, we can not only agree upon bridging standards, but also collaborate on standards peculiar to C4I or M&S.

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COMMAND DECISION MODELING (CDM)

STANDARDS CATEGORY DEFINITION

Procedures, practices, processes, techniques, data, and algorithms that model or simulate human behavior that result in a perception being formed, a decision being made, an action or reaction, or a plan being formulated.

STANDARDS REQUIREMENTS

a. Objective - Advance the art of modeling decision making processes for SAFOR, CGF, and constructive simulations.

b. FY99 Goals:

- Foster communication and identify gaps in community CDM research efforts.
- Develop a collective requirement document for CDM to identify product expectations.
- Examine mission-planning applications of CDM.
- Explore representation of the individual as an agent.

ACCOMPLISHMENTS AND ASSESSMENT

a. PLANNING PROCESS STANDARD

1. **Accomplishments**:

The aim of this project is to examine the reuse of an existing artificial intelligence planning system (Adversarial Planner) as one means of automating command decision making at a level adequate to eliminate lower echelon simulation role players. Command Entities in WARSIM 2000 must emphasize planning and deciding how to accomplish stated and implied goals communicated in operations orders. We chose Adversarial Planner (AP) as the existing planning system to reuse in this effort. Reusing this task decomposition planning system helped to test the hypothesis that mid-echelon planning and monitoring cognitive activities can be simulated adequately to meet training requirements of a system such as WARSIM 2000.

AP's capabilities include:

- Generating coordinated actions (plans) for each resolution unit (subordinate) based on orders from higher.

- Monitoring plan execution based on situation and spot reports from subordinates.
- Re-planning when execution deviates from the plan or when a new order is received from higher.

AP uses task decomposition planning to generate subordinate plans from higher headquarters's orders. Briefly, task composition begins when a user (possibly in the form of an order) specifies a goal—a state-based description of a task to be accomplished. The planning algorithm uses application-specific templates called "operators" to decompose the goal into more concrete subgoals, eventually bottoming out in actions that the subordinate agents (units) are able to execute (possibly by further task decomposition).

For any goal or subgoal, there generally will be several templates that can be expanded to fulfill it. (If there were always only one "script" to fulfill a subgoal then the problem would be one of control, not planning) AP uses decision analysis to choose which operation can fulfill a given subgoal. Therefore, AP is based on a normative model of planning, rather than a descriptive cognitive model. The user can, however, bias the utility function to favor certain types of operations over others to reflect, say, aggressive or conservative command style.

AP extends the classical task decomposition framework to include multi-agent coordination. That is, it plans organized actions for multiple subordinate agents to accomplish subgoals. This means that a primary concern is reasoning about how to coordinate actions in time. Using an example of an envelopment to defeat an enemy, the planner would determine the number of units attacking and where and *when* they must start the implied subtasks. In this example, the attacks must start simultaneously, or a unit that begins too early may take heavy casualties. Multi-agent coordination is one of the capabilities that led us to select AP as a possible model of command decision making in WARSIM.

Another important characteristic of command staff planning is reasoning about potential reactions of the enemy and augmenting the plan with counteractions to foil these reactions. AP implements an action-reaction-counteraction cycle modeled on course of action development doctrine outlined in Army Field Manual 101-5 *Staff Organizations and Operations*.

Because of the adversarial nature of the ground maneuver domain, a primary function of a command entity is to monitor execution and replan when, not if, the unfolding battle deviates from the current plan's projections. AP uses the plan structure to monitor execution and replan. AP continually compares anticipated states of the world with the perceived situation, constructed by processing situation and spot reports from subordinates. When the perceived situation deviates from the predicted state enough that it is clear the plan will fail, replanning modifies the current plan and causes revised orders to be transmitted to subordinates. AP's

replanning strategy is to maintain as much of the plan as possible, only replacing subplans that are crucial to success.

We were successful in rehosting and reimplementing the AP software independent of the Eagle simulation on a Windows NT workstation. The AP software was then connected to the WARSIM 2000 Testbed prototype in Orlando, FL.

Now that AP has been independently implemented, we are examining how to integrate the software into the NSC's Military Art of Command Environment simulation in which we are using a multi-paradigm approach to address Command Decision Modeling research issues.

In addition to the rehosting effort, we are currently examining the planning process documented by the Army's Operational Architecture and the dynamic model we developed as a means of incorporating AP technology. This effort is in collaboration with TPIO-ABCS.

2. Lessons Learned:
AP imposes little overhead on the Testbed. Planning for five subordinate units takes less than five seconds on a 300 Mhz Pentium II NT with 128MB. However, our prototype is in an early state. As we add terrain reasoning, complex representations of the battlefield operational systems, and cognitive biases due to perceived truth, processing requirements will increase. Because we run AP in a separate process, performance issues, should they arise, can be addressed with a faster machine by multi-processing. This may be necessary as we start running several copies of AP, one for each command being simulated.

3. Benefits to the Army:
The WARSIM 2000 program is considering several methods for implementing cognitive behaviors associated with course of action planning and execution control. The planning prototype based on previous AP work accomplishes many of the primary requirements of a generative planning capability for WARSIM 2000, and will serve as a baseline for comparison to other behavior modeling methods not yet examined.

The effort to migrate AP technology to a Windows NT environment using common LISP, makes the product more reusable by other efforts and proves that it can be re-implemented to support other simulation environments.

The final result of the benefits of this investigation will be seen when other methods are implemented within the testbed environment and we are better able to assess the benefits and issues associated with a multi-paradigm approach to command decision modeling,

2. Work remaining to be completed:
We have completed the first prototype and have produced a users guide for AP technology that resides on the CDM website. Our next efforts will be to take the more general common

LISP AP and rehost the software in our G2 based Military Art of Command Environment (MACE).

5. Schedules with milestones:
The software effort has been completed. A user's guide has been published. We now will develop a normative standard that we can place in SNAP and ASTARS for the M&S community to reference and expect to complete this work by November 1998. We hope to continue the rehosting effort as a part of our collaborative Command Decision Modeling work with the United Kingdom in FY99. Our collaborative work will make use of the command agent architecture which was developed during the DUSA (OR) sponsored 2d US/UK CDM Workshop and which will be expanded upon at the upcoming 3d US/UK Workshop, 27 July 1998 to 4 August 1998.

b. BATTLE MANAGEMENT LANGUAGE AND KNOWLEDGE REPRESENTATION STANDARD

1. Accomplishments:
The intent of this effort was to develop a common vocabulary to represent the command and control decision-making process in modeling and simulation software. Analysis of various existing vocabularies is still on-going at this stage of the effort. We have looked at the Command and Control Simulation Interface Language (CCSIL), the Eagle model's Battle Management Language (BML) and DARPA's Knowledge Query and Manipulation Language (KQML). We have also carefully studied the TPIO-ABCS developed Army Operational Architecture (OA) and the development language of an object oriented systems processing software called G2.

Our analysis and prototyping efforts thus far reveals that the various languages associated with current simulations are parochial in code and development to that simulation with varying degrees of detail and complexity. The OA provides a detailed and vigorous description of information flow for all staff processes. The G2 model and its easy to use developmental language combined with the OA allows an innovative approach to a battle management language development by modeling this complex subject graphically as objects. Though novel, this approach as a standard would be revolutionary rather than evolutionary.

Our current approach is two-phased. We will attempt to develop a standard that supports current as well as future simulations based on the languages we have reviewed. We will also continue to investigate developing the language standard in an object-oriented environment. We are currently planning to finish to finish a quality product which we can place in SNAP and ASTARS by 30 September 1998.

Lessons learned:

- Approaching the problem using the OA modeled by G2 provides a rich language and a dynamic means to study and analyze effects of resource, time or inputs in the decision making process.
- Using the rapid prototyping capability of G2, we can develop new more flexible language at a much faster pace.
- Using the TPIO-ABCS OA as a language basis takes an advantage of a validated TRADOC product describing information processes across all echelons of battle staff decision-making processes.
- Reviewing the OA from the simulation language point-of-view provides the opportunity to give feedback to TPIO-ABCS on the consistency of their doctrinal language.

2. Benefits to the Army:

- A standard Battlefield Management Language would reduce the cost of developing new models and simulations.
- A standard language would increase the efficiency of any development process because of the commonality of language and the ability to rapidly transmit and assimilate it.

3. Work remaining to be completed:

Produce a standardized Battle Management Language model and user's guide which provides operational data in a format such that a computer can reason on it . This will facilitate command and planning knowledge to feed decision support services used by multiple command agents.

Show specific accomplishments and the M&S objective that each accomplishment supports. As part of this section, discuss the adequacy of Army and DoD investments in technology related to the category. The assessment should also discuss the utility and adequacy of output from DoD initiatives and executive agents as they affect work within the standards category.

4. Schedules with milestones:

Publish the Battle Management Language model and user's guide by 30 September 1998.

c. BATTLE COMMAND PROCESS & INFORMATION FLOW REPRESENTATION

1. **Accomplishments:**

The intent of this effort was to develop a methodology and an approach for representing battlefield information flow. We examined several COTS tools to include: colored-petri net software, OPNET communications modeling software, Object-Time finite state machine modeling software as well as AI case tools provided to us by the DISC4 Strategic and Advanced Computing Center (SACC). As a result, we chose Gensym's G2 development environment for its ability to incorporate numerous techniques for implementing artificial intelligence and its natural language interface. This allowed us to develop a graphical

programming language, which we used to represent our prototype of the brigade planning process. As a result of the ease of use of our case tool, we were able to develop an actual prototype and are planning to grow this effort in collaboration with TPIO-ABCS.

We looked at several sources of information for determining how information products would flow into, within, and out of a battle staff. We chose to create a dynamic representation of the Army's Operational Architecture (OA) for a heavy brigade decision making process. The OA, built and configuration managed by TPIO-ABCS, provides an IDEF representation of the Army's business process. In other words, the OA is a representation of the information products and data that flows between the various staff elements and echelons in the field.

The OA gave us a good basis for examination of the robustness of our representation methodology and its potential extensibility from corps down to company level. In addition, because we are using the Army's Architecture which is under TPIO-ABCS configuration management, our model has direct traceability to the validated TRADOC product representing the decision making process.

The National Ground Intelligence Center (NGIC) has participated in our case tool selection, case tool training, and prototyping effort as well. As a result, we will in the next phase, use the methodology to develop a prototype representation of a threat OA.

2. **Lessons learned:**

In reviewing case tools, we found it very difficult to restrict ourselves to a methodology that was based on finite state machines. This was due to the parallel nature of the planning process, especially at the higher echelons. G2 does not have this limitation.

Using a validated source of information such as the Operational Architecture saved us a large amount of time that would have been spent synthesizing documentation and doctrine into a suitable format for model development.

G2 does not have any limitations on naming objects, so we were able to preserve the actual terminology utilized by the Operational Architecture, which aids traceability and understanding of the model.

3. Benefits to the Army:

We have gained a better understanding of what simulations such as WARSIM 2000 require to accurately represent the doctrinal decision making process and information flow on the battlefield. As a result of this effort, we have developed a tool that can be grown to:

- Provide analytical underpinnings-Budget/Fielding/POM Decisions

- Offer empirical data to address DTLOMS solutions
- Provide the ability to compare and analyze courses of action for battlefield process reengineering (BPR) opportunities/recommendations/improvements
- Provide the capability to document the warfighter's view of his fighting architectures
- Project "Quick-turn analysis" potential
- Provide analytic support to systems performance modeling (SPM) efforts/initiatives

4. **Work remaining to be completed**:
The basic effort has been completed and we have developed a sound object-oriented methodology and model for developing dynamic representation of battle command information flow processes. The work to date has exceeded expected goals and we are in the process of planning a program of growth for this effort. We have completed a prototype link of the OA (information flow model) to our Military Art of Command Environment (MACE) simulation which is a result of our Multi-Paradigm Command Decision Modeling Architecture. We look forward to utilizing the methodology to provide a means of synchronizing the command agents we are developing.

5. **Schedules with milestones**:
A technical report detailing the representation methodology developed will be placed in ASTARS in September/October 1998. We will continue to develop our prototype and are planning to continue this SIMTECH/DCSINT seeded effort as a partner of the Task 9 Enterprise Modeling and Simulation effort

d. MULTI-PARADIGM COMMAND DECISION MODELING ARCHITECTURE

1. **Accomplishments**:
The intent of this effort was to examine the technical issues and challenges associated with developing a multi-paradigm command decision modeling architecture spanning higher echelons of command. As part of this effort, we were able to establish multi-paradigm command decision modeling testbeds at JPL/NASA and the NSC. The SIMTECH program funded the JPL/NASA testbed effort. The JPL/NASA effort established a testbed environment for experimentation with OPFOR automation concepts while the NSC WARSIM Testbed efforts focused on the creation of BLUFOR multi-paradigm command entities.

This effort has made use of the command agent architecture that was developed during the 2nd US/United Kingdom CDM Workshop hosted on behalf of the DUSA(OR) in December 1996. The effort also examined the implementation of a Command Decision Modeling (CDM) prototype that employs a two phase approach of: (1) situation assessment and (2) option assessment to provide a course of action based on goals/objectives.

We chose the two-phased approach to closely model the military paradigm of a commander and his staff. The staff analyzes and interprets battlefield processes with specialized expert knowledge and current situation information and provides the resulting synthesized information to their commander so that he or she does not have to process large amounts of information. We will review and utilize intelligent agent techniques applied in industry to model this relationship. We in the NSC portion of the testbed are beginning to design multiple advisor agents which will perform situation assessment and provide estimates of the situation to a command agent which will choose course(s) of action based on its knowledge base and objectives.

The intent of this style architecture is to allow for the implementation of multiple advisor agents which use artificial intelligence techniques appropriate for their knowledge source(s) and a command agent which uses a knowledge based technique such as an expert system with a blackboard architecture. The interfaces between the advisor agents and the command agents are of a generic design to support the inclusion of additional advisor agents or the replacement of implemented advisors. An ability to interactively view/add/update goals and provide explanations for the courses of action chosen is planned.

We reviewed existing CFOR/CCSIL software and as part of the JPL/NASA portion of the testbed we chose to reuse the CFOR CCSIL message parsing software as part of our orders input capability to the simulation.

As far as the value of the product we produced, we feel we achieved great progress in the objective of automating the activities of the enemy on the battlefield. At the 16 June 1998 demonstration to Director, NSC and Director, TRAC, participants validated this assertion by stating that our CDM efforts will not only significantly reduce the manual effort of inputting orders into a simulation from hours to minutes but will reduce manpower overhead during exercise events.

2. Lessons learned:

The DISC4 Strategic and Advanced Computing Center provided the NSC WARSIM Testbed a software process development case tool called G2. We are currently developing our CDM prototypes with G2 It provides a core capability that allowed us as the subject matter experts to rapidly develop the foundation for our MACE simulation as well as the OPFOR command agent work produced under the NASA/JPL effort. G2 is capable of supporting multiple technology paradigms so that we have avoided the integration issues associated with using separate tool suites such as a neural network, rule based system, and fuzzy logic only to run into major problems in integrating the tools for a final product. The rapid prototyping capability of G2 allows us to "white board" our concepts in software so that we can share

and examine our ideas with other agencies such as STRICOM for applicability to WARSIM 2000. Having now established the initial core JPL/NASA and NSC testbeds, we realized the capability to prototype concepts that provide invaluable insights for refinement of CDM concepts before we implement them on a large scale in programs such as WARSIM 2000, JSIMS, and JWARS. This has the potential to bring monetary and functionality dividends to simulation programs.

3. Benefits to the Army:

The intent of this effort was to establish a base for growth and experimentation leading to the development of M&S community practices and standards in modeling the military decision making process. We hope to continue to use both testbeds for future experimentation and are meeting with organizations such as CECOM, STRICOM, BCBL, DISC4, TRAC, TPIO-ABCS, DCSINT, DMSO and others to form collabrative relationships and establish a program of research that will help to mitigate some of the risk of developing automated units for programs such as WARSIM 2000, JSIMS, and JWARS. Additionally, the efforts from this program directly support the role player and controller reductions intended for simulations such as WARSIM 2000.

4. **Work remaining to be completed:**

NASA/JPL will participate in the 3rd US/UK Command Decision Modeling Workshop from 27 July 1998 to 4 August 1998.

NASA/JPL will complete user documentation and will deliver the software produced to the NSC as the final task of this SIMTECH funded effort.

We also are continuing our in-house MACE effort and will begin development of the additional command agents in accordance with our design documentation. We will also be developing a collabrative prototype at the 3rd US/UK CDM Workshop which will most likely use the MACE environment as a base.

5. **Schedules with milestones:**

NASA/JPL will support the 3rd US/UK Command Decision Modeling Workshop in the United Kingdom with a presentation on Smart Enemy Agent efforts and a demonstration video of the working system.

We will be using our MACE environment as a basis for development of a collaborative prototype between the US and UK. This will be our first such effort and should stimulate the growth of the partnering relationship we are trying to establish with the UK.

NASA/JPL will deliver to the NSC, user documentation and software developed to support both the existing task and the additional US/UK workshop task in August 1998.

e. CDM LAB

The WARSIM Directorate has a Command Decision Modeling Multi-Paradigm Environment called the Military Art of Command Environment (MACE). This effort supports the development of role-player automation for simulations and provides an experimentation environment for developing Command Decision Modeling (CDM) standards as part of our Charter under the Deputy Under Secretary of the Army for Operations Research (DUSA(OR)) as CDM Standards Category Coordinator (SCC). Efforts conducted under the DUSA(OR) Charter support the models and simulations community at large. Current customers are WARSIM 2000 for CDM, TPIO-ABCS for Operational Architecture modeling support, and soon CECOM for development of planning components to feed the "C4I Tool Kit". Potential customers include JSIMS, JWARS, AWARS, COMBAT XXI, and OneSAF.

On 16 June 1998, the NSC WARSIM Testbed presented our simulation prototypes to Dir, NSC and Dir, TRAC along with representatives from other organizations. The prototypes were very favorably received, and the NSC WARSIM Testbed was directed to continue development of MACE.

Currently, MACE projects/components include: a reference architecture and foundation simulation environment at the Division through Battalion level, a dynamic model of the Brigade Operational Architecture (OA) (the TPIO-ABCS portion of the Army's Enterprise Strategy), an experimental 3D environment for terrain visualization, the command planning process software developed by MITRE called Adversarial Planner, and a NASA/JPL product called Smart Enemy Agent (SEA).

Part of the MACE concept is to establish and expand a virtual laboratory environment for the development of command decision modeling technologies with TRAC, STRICOM, Lockheed Martin (the prime contractor for WARSIM 2000), National Ground Intelligence Center (NGIC), NASA/JPL (our Smart Enemy Agent (SEA) contractor), MITRE (our C4I contractor), CECOM, CGSC, BCBL, and other sites.

Our development approach is user focused. We have an integrated team consisting of military SMEs and programmers. We also partner with other organizations as appropriate to expand our base of expertise. Our position as the SCC for CDM facilitates the integration of these community efforts. We constantly look to new technologies and techniques to experiment with and try new and innovative concepts to solve problems as resources permit. We use our SCC reflector as a sounding board for ideas and concepts enlisting participation from government, industry, and educational institutions.

We are currently developing our simulation experimentation environment with a software product called G2. G2 is an AI case tool, which was provided to the NSC WARSIM Testbed by the DISC4 Center for Strategic Simulation (formerly know as the Army AI Center). G2 provides a core capability and allows us to rapidly develop the foundation for

MACE. We also constantly monitor the M&S community for new computer technologies that could assist us in our efforts.

Now that we have the basic framework in place, we will start developing our cognitive prototypes. As these prototypes are developed, we will integrate them with other ongoing work. Results from our work will be used to help define Army standards for Command Decision Modeling. These products will feed into the development of WARSIM 2000 and will available for use by the M&S community.

CDM is a high-risk area with great potential payoffs if successful. It is a very challenging area with many efforts ongoing. Hopefully through coordination with other HQ, DA and DOD organizations in a forum that supports many interested parties as possible, some significant breakthroughs in this area can be realized in the near future.

PRIORITIES FOR NEXT YEAR

1. Development of normative CDM Standards for the M&S Community. Below is the timetable.

Standards and Timetable for Implementation into SNAP	
STANDARD	**DATE**
Concept of Unit Perceived Truth	1 Jul 98
Human Performance Algorithms (Sleep & other stressors)	15 Jul 98
Operational Architecture Mission/Task Terminology	30 Jul 98
Model of Planning Process	30 Sep 98
Representation of Commander's Traits	1 Nov 98
Command Agent Architecture (US/UK)	1 Aug 98

2. Conducting research on and prototyping of command agent architectures, ormative behavior models, and object-oriented behavioral representation.

CDM Composable Behavior Representation AMIP Proposal

EXECUTIVE SUMMARY

This proposal will identify and capture within a class hierarchy a standard way to represent cognitive methods. Products of this effort will be a Behavioral Object Taxonomy for Corps to Co Level and associated Cognitive Modeling Framework. The benefit of the proposed research would be more flexible and rapid development of command and control simulation by taking advantage of the object-oriented model development paradigm. This effort will feed the development of behavioral object standards to used by simulations such as JSIMS,

WARSIM 2000, and OneSAF. This project will be executed under an existing NSC support contract with CUBIC Applications, Inc. in the NSC Command Decision Modeling Laboratory.

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

The primary objectives of this framework are to:

- Identify and capture within a class hierarchy the standard ways to represent the run-time data requirements of cognitive models.
- Identify and develop the mechanisms to create a standard execution environment for cognitive models representing the behavior of decision-making entities within a larger simulation application.
- Identity standard cognitive model composition mechanisms that support the creation of a standard command and control language.

The framework design proposed takes the view that problem solving tends to be goal oriented and that rarely does a problem have a simple, step-wise procedure that yields the desired solution. It is the absence of a single, clear procedure that gives problem solving its inherent difficulty and complexity.

In order to deal with this dilemma, we propose that the problem be decomposed into tasks, where a task represents some fundamental unit of activity. This is an effective way of managing the complexity of problem solving and the Army Operational Architecture provides the template for the development of these fundamental units.

This view of problem solving is coupled with the understanding that cognitive models have many and varied data requirements and that cognitive model building can be viewed as a composition activity, where fundamental units of modeled behavior (tasks) are linked together to form more complete models of human behavior and command and control models.

In addition, task models that are loosely coupled and highly configurable maximize reuse and support mixed fidelity modeling. Flexible, dynamic task model composition mechanisms support the ability to express a wide variety of command decision-making behaviors via a command and control language.

TECHNICAL APPROACH

The proposed approach consists of the following steps.

- Analyze existing software implementations and models for possible reuse or incorporation into this project.
- Collect the general Operational Architecture terms from corps to company level for Command Decision Modeling.
- Establish a vocabulary from the architecture for representing command decision modeling behavior primitives.
- Develop taxonomy for these primitives.
- Research the appropriate implementation of this taxonomy.
- Complete the Cognitive Modeling Framework

PRODUCTS

Behavioral Object Taxonomy for Corps to Co Level
Cognitive Modeling Framework

MILESTONES

Milestone	1	2	3	4	5	6	7	8	9	10	11	12
Review of existing Simulation Implementations and Concepts	X											
Collection of General Scenarios Architectures	X	X										
Develop Vocabulary of Representational Primitives		X	X	X								
Behavioral Object Taxonomy for Corps to Co Level					X	X						
Develop Hierarchical Model for Behaviors						X	X	X				
Research Appropriate Implementation of Hierarchy								X	X			
Cognitive Modeling Framework										X	X	X
Finalize Reports												X

RISK/BENEFIT ANALYSIS

The benefit of the proposed research would be more flexible and rapid development of command and control simulation by taking advantage of the object-oriented model development paradigm. This effort will feed the development of behavioral object standards to used by simulations such as JSIMS, WARSIM 2000, and OneSAF.

EXECUTABILITY

This project will be executed under an existing NSC support contract with CUBIC Applications, Inc.

Development of CDM reflector forum supporting open community discussion of standards, technology, and implementations. We will try to do this try experimental events and innovative concepts. Below is an example of one of our upcoming events.

3. Reflector Discussions for 3rd US/UK Command Decision Modeling Workshop

The 3rd US/UK Command Decision Modeling workshop will take place from the 27th to 1st July at DERA Fort Halstead. The workshop will be held in the "library", building Q6 at Fort Halstead. The workshop has been structured so that each day focuses on a particular aspect of Command Decision Modeling. However, the real focus for the week will be a collaborative Command Decision Modeling project, undertaken during the course of the week and drawing on the expertise of everyone present. It is hoped to begin some discussion via e-mail (and ICE for DERA participants) as to the nature of this collaborative project. It is then anticipated that ideas as to what exactly the project should be will evolve over the first two and half days of the presentations and discussion at the workshop and then the remainder of the week will focus on achieving this collaborative piece of work. For those of you unable to attend in person you can participate via our Command Decision Modeling Reflector.

We would like to focus our modeling efforts on using G2 to implement the Command Agent Functional Architecture from the 2nd US/UK Workshop in G2. The attached Powerpoint file has diagrams that illustrate this architecture. We want to model the agents and structure necessary to implement the Commander's Assessment Block in great detail. We propose using the U.S. Army's Operational Architecture as the basis for modeling the Commander's Assessment. The Receive Mission block of the Plan Future Operations Architecture and the definition of the Command Agent's Commander's Assessment are complementary. The OA inputs will be used by the Commander's Assessment prototype, and the OA outputs will define the content of the Commander's Assessment.

To get as much input and feedback into this process we are proposing a very interactive and Internet based development approach. This announcement will be posted to two reflectors, one in the U.S. the other in the U.K. These reflectors will be used to collect comments and ideas on how to implement the Commander's Assessment Block. At the actual workshop, the collected ideas and discussions to date will be presented. The workshop participants then will be able to contribute to the development of the prototype. Each day a daily summary of the workshop activities as well as the status of the prototype will be posted to both reflectors so that further discussions can take place. This way the reflectors will be used to communicate to the M&S community. Each day the reflector discussions from the previous

day will be presented during the conference. We invite everyone to participate in this experiment and to contribute his or her ideas to make this project a success. The results from the workshop will be placed on the CDM homepage at the completion of the workshop.

To get this started we are requesting that you let as many people as possible know about this upcoming event. It will take place from July 27 - 31 1998. We are soliciting comments now. These comments will be collected and presented the first day of the conference. Preworkshop comments on the proposed CDMW prototype need to be posted to the reflector by COB Friday, July 24, so they will be incorporated into the first day of the 3rd US/UK CDM Workshop on Monday, July 27. If you have any existing documentation that you think could provide insight into this, please feel free to share you ideas with us. We need comments from each organization signed up to the reflector to make this workshop a success and truly interactive. Each day as the workshop progresses we need each of you to look for email from Jenni Henderson or me. This email will be a posting of the daily activities; please provide appropriate comments so we can use them at the following day's workshop. Send your comments to amso-scc-cdm@sc.ist.ucf.edu. Since there is a big time difference we need everyone to comment quickly on the workshop updates and the prototyping effort for this to be a success.

4. **Continued expansion of the CDM world-wide web page into a repository of information for command decision modelers.**

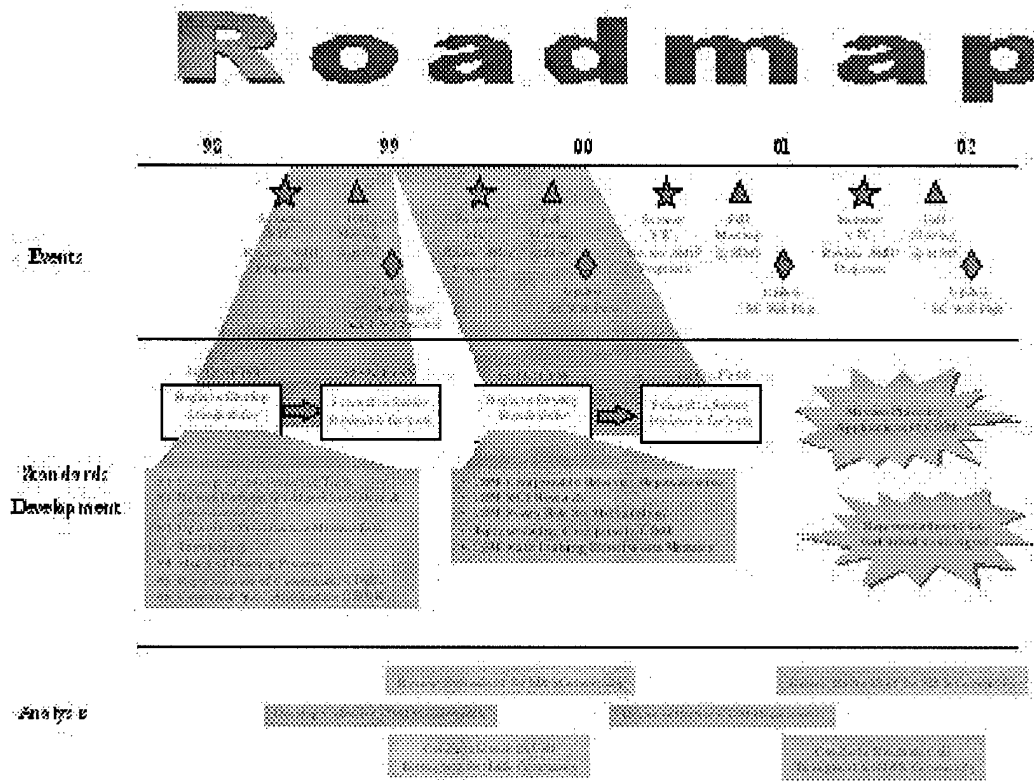
5. **Continuing to canvass the community for additional assessments of command decision modeling technology. Below is a table of members of the CDM team that are working various projects in this area.**

Name	**Organization**	**Position**
Sean MacKinnon	NSC	Chair
Marilyn Macklin	DCSINT	Co-Chair
Kevin Gipson	NSC	Member
Barbara Pemberton	STRICOM	Member
Dave Hoffman	TRAC-WSMR	Member
Dr. Chris Barrett	LANL	Member
Dr. Chris Elsaesser	MITRE	Member
Dr. Phil Gillis	ARI	Member
Janet Morrow	NGIC	Member
MAJ John McKitrick	Army AI Center	Member
Penny Mellies	TSD - DCSINT	Member
Mike Freeman	BCBL	Member

LTC Belenky	WRAIR	Member
Dick Brown	TPIO-ABCS	Member
Jenni Henderson	UK DERA	Member

This list is not all inclusive and membership is open to all government agencies, academia, industry as well as international participation. The CDM SCC typically distributes reports and other information to 40 plus members. This truncated list represents those that have been most active in supporting the standards category.

ROADMAP


Roadmap
98
99
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02
Events
Standards Development
Analysis

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Annual Standards Category Report for FY99

COMMUNICATION SYSTEMS

STANDARDS CATEGORY DEFINITION

Battlefield Algorithms - Control, Communications, and Computers (C3). The Communication System Category standards includes the objects, algorithms, data, and processes necessary to replicate friendly and enemy C3 systems and processes.

STANDARDIZATION REQUIREMENTS

The standardization requirements as described in the Army Model and Simulation Plan are:

1. Define and design objective C3 systems M&S Representation.
2. Coordinate common C3 systems representations with other categories.
3. Upgrade current M&S capabilities to replicate existing and emerging C3 systems.
4. Insure design will permit systems interface with other M&S in the constructive and virtual worlds.
5. Insure HLA compliance is part of the development of new M&S communications models.
6. Provide for data interchange to allow communications effects to play in combat models.
7. Develop MOEs to identify key elements and validation tolerances for CS M&S.
8. Insure the models are available to users.

ACCOMPLISHMENTS AND ASSESSMENT

A. Team Building: Team invitations have been sent to those government agencies who are involved in the development of C3 doctrine, architecture, and the acquisition of hardware/ software to support the mission needs. Representation from ADO, CECOM, ARL, and SIGCEN attended the M&S workshop held at Carlisle Barracks Pa. on 4-7 May 1998. Discussion on the AMIP project submissions was held.

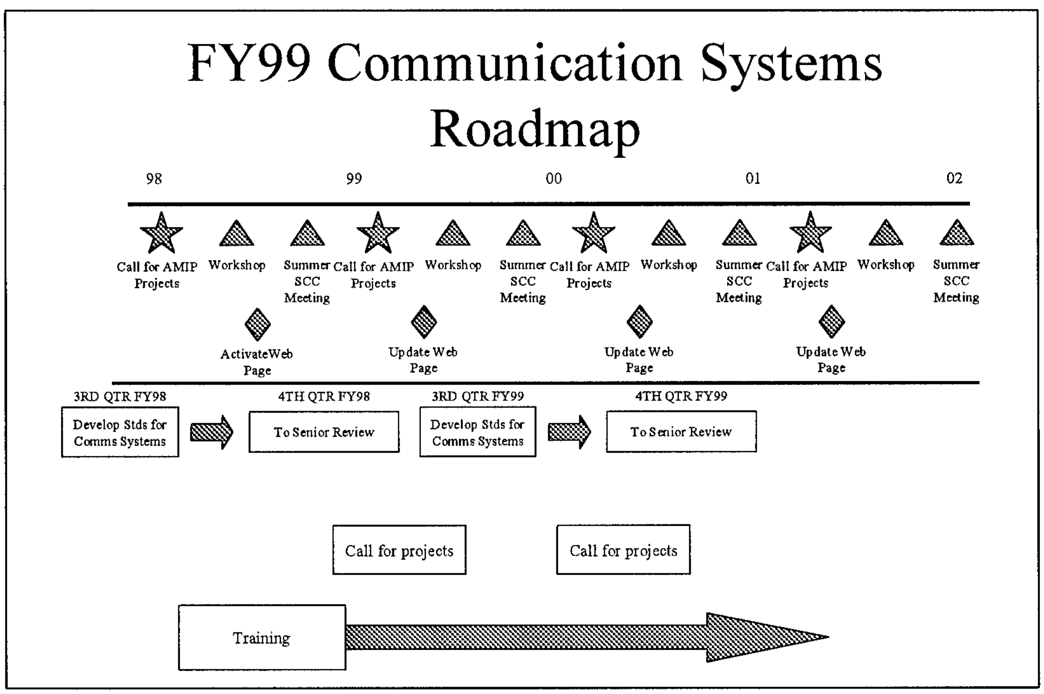
A web page has been developed and can be found on the SIGCEN DCD web page www.gordon.army.mil/dcd then follow the menu. In addition research and eventual establishment of a repository for M&S tools useable for communications systems modeling will be accomplished. Modeling of communications systems is under upgrade. The major development tool of choice is a commercial product entitled OPNET. Involved in this

development is the need to set parameters under which OPNET developed modules must operate. Interchangeability is a primary requisite for these parameters, and will insure usability regardless of who develops the module.

PRIORITIES FOR NEXT YEAR

1. Maintain membership in the team.
2. Keep the web page current.
3. Complete definition of a repository - Determine procedures for operation and insure configuration management is applied.
4. Obtain communications module information and compile a list of available OPNET modules that can be used by the M&S community.
5. Specify standard terrain and force structure to be used as a baseline for modeling.
6. Develop methodologies that can be used as standards.
7. Provide Education

ROADMAP



Annual Standards Category Report for FY99

COST REPRESENTATION

STANDARDS CATEGORY DEFINITION

The Cost Representation standards category addresses Army standard cost definitions and the data, tools, algorithms, and techniques necessary to accurately and consistently prepare and portray cost and economic analyses for military operations, acquisitions, and modeling and simulation activities.

STANDARDS REQUIREMENTS

Develop, document, and promote Army standard cost definitions, data, tools, algorithms, and techniques for preparing and portraying cost and economic analyses for military operations, acquisitions, and modeling and simulation activities. Standardize techniques for comparing the costs of alternatives. As necessary, update the Army's principal publications containing cost standards and guidance: AR 11-18, *The Cost and Economic Analysis Program*; the *Department of the Army Cost Analysis Manual*; and the *Department of Army Economic Analysis Manual*. Lead Army Cost Analysis initiatives in support of Simulation Based Acquisition (SBA). Interface with the other Army Model and Simulation Standards Categories.

ACCOMPLISHMENTS AND ASSESSMENT

The U.S. Army Cost and Economic Analysis Center (CEAC) chairs the Cost Representation Standards Category. During the last year, CEAC continued to develop, improve and field cost estimating tools and models, and cost databases. The major accomplishments follow:

Updated the Automated Cost Estimating Integrated Tools (ACEIT) resulting in reduced calculation time, enhanced import/export capabilities, improved linkage to the materiel commodity-based Automated Cost Data Base (ACDB), and an improved RI$K Executive. ACEIT is the standard Army automated framework/spreadsheet that is designed to improve reporting consistency and increase productivity of cost analysis work. The Army, Air Force and the Navy endorse ACEIT as the recommended tool for their cost analysts to use. ACEIT automates the detailed, tedious costing functions and documentation allowing analysts more time to develop costing methodology and perform analysis. The ACEIT model is improved continuously. ACEIT includes a Cost Analysis Statistical Package (CO$TAT) that supports the requirement of cost analysts to assess risk in cost estimates. ACEIT planned updates include linkage to the Army Manpower Cost System (AMCOS) model, a personnel costing model. AMCOS addresses costs of active military, reserve (Army and National Guard), and civilians by grade and MOS/skill. CEAC continues to train analysts in the use of ACEIT. ACEIT enhancements are planned to improve Cost as an Independent Variable (CAIV)

capability.

Updated and expanded the Automated Cost Data Base (ACDB), containing cost, technical and programmatic data from Contractor Cost Data Reports (CCDRs), Contractor Performance Reports (CPRs), contracts and other sources. The missile ACDB was fielded. CEAC is planning to expand the ACDB by adding an Aircraft module, a Composite Materials database, and a Wheeled and Tracked Vehicle Module.

Updated the Force and Organizational Cost Estimating System (FORCES) model, a suite of models including a force cost model, force cost factor database, cost factors handbook, military end strength reduction model and civilian manpower reduction model. FORCES is updated for cost factors and increased capabilities.

Updated and expanded the Operating and Support Management Information System (OSMIS), an automated database of normalized, actual materiel operating costs used for Army OPTEMPO budgeting and Operations and Support acquisition costing. This data is collected annually, analyzed, distributed and used Army-wide.

CEAC continued to promote Army cost and economic analysis standards by distributing the Department of the Army Cost Analysis Manual and the Department of the Army Economic Analysis Manual, by facilitating the training of Army cost analysts in the use of ACEIT, and by providing expert cost estimating guidance.

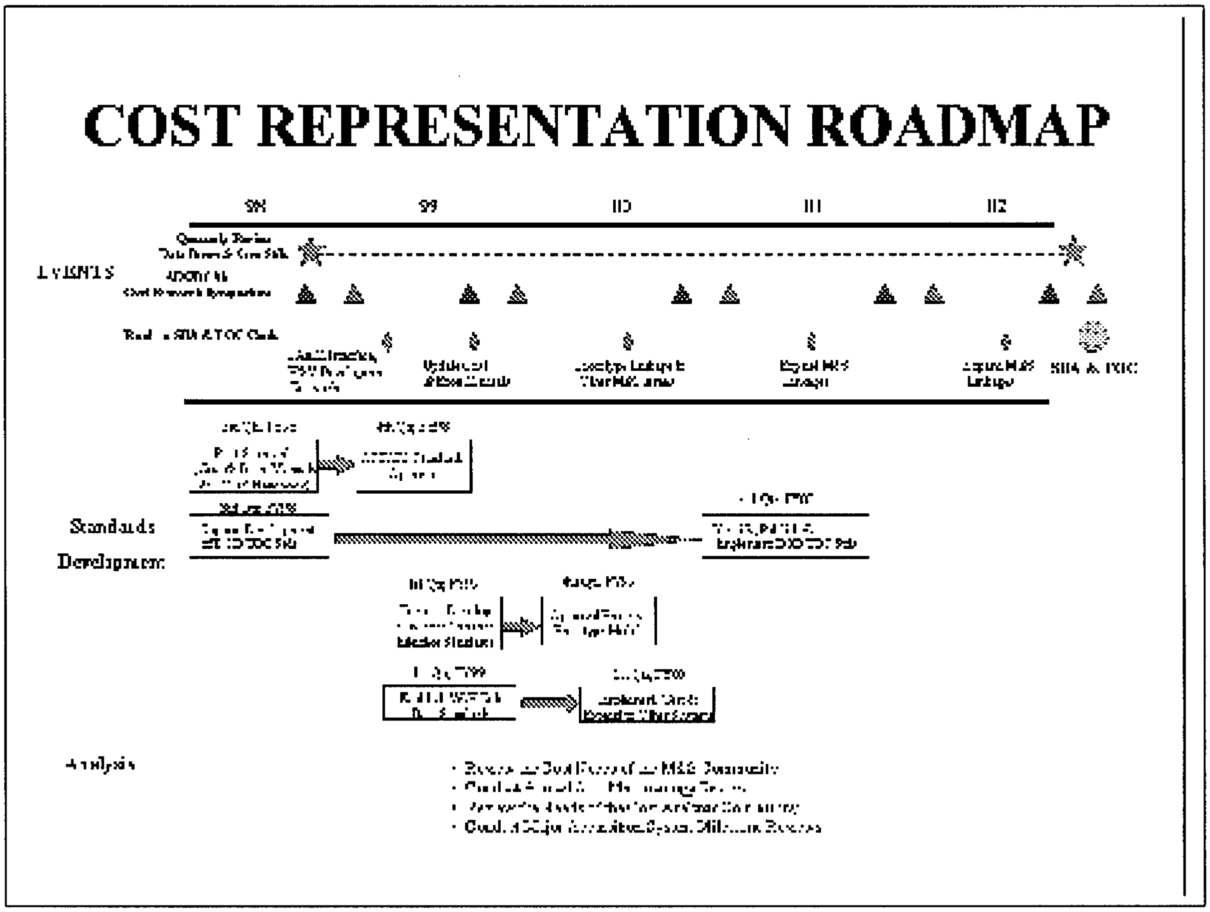
PRIORITIES FOR NEXT YEAR

1. Maintain latest information on the CEAC web site http://www.ceac.army.mil/default.htm
2. Continue to integrate and improve the various cost models and databases (ACEIT, CCDR, OSMIS, FORCES, and AMCOS).
3. Review the *Department of the Army Cost Analysis Manual and the Department of the Army Economic Analysis Manual* to determine if an update is needed to reflect the dynamic environment initiated by Acquisition Reform, the National Performance Review, and other initiatives.
4. Provide validation and verification of cost in models and simulations, as required.
5. Provide support to improve and expand applications, cost methods, and databases.
6. Develop new databases, tools, algorithms and techniques necessary to accommodate Simulation Based Acquisition (SBA) initiatives.
7. Nominate and obtain approval of additional Cost Representation standards via the Standards Nomination and Approval Process (SNAP) and the Army Standards Repository System (ASTARS).

8. Expand the interfacing and coordination of the Cost Representation Standards Category with the other models and simulation Standards Categories.

ROADMAP

The following figure highlights the goals, events and processes of the Cost Representation Standards Category during the entry into the 21st Century:



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Annual Standards Category Report for FY99

DATA

STANDARDS CATEGORY DEFINITION

The Data Standards Category is defined as encompassing all areas that increase information sharing effectiveness by establishing standardization of data elements, database construction, accessibility procedures, system communication, data maintenance and control. This category includes, but is not limited to, the development and maintenance of standards for nomenclatures, data element representation (data models), data interchange formats, data verification, validation, and certification, data modeling standards, and other software related to databases and data visualization. This category is limited to data used for modeling and simulations within the Army and includes item level performance data and characteristics (for Blue, Red, Gray and Green systems), logistics data used in Army M&S, environmental effects data, Army generated terrain data and test data. The Data Standards Category does not address data standards for cost, other financial data, personnel data, and terrain data produced by the Defense Mapping Agency.

STANDARDS REQUIREMENTS

The need for reliable and accessible data in standardized formats is one of the most frequently cited issues for Army M&S. Priorities for the Data Standards Category have been established to:

1. Promote Data Standards. Effective data communication begins with standards in format, content and naming of entities. Without these standards, users of data cannot be certain that they are correctly representing the entities in models and simulations. Priority should be given to the identification, proliferation and incorporation of standards into new and existing databases. For this to occur, priority must also be given to developing standard data models and incorporating them into the DoD Data Dictionary.

2. Develop Infrastructure. Resources should be devoted to the development and maintenance of the infrastructure required to support data standards. This infrastructure includes, but is not limited to, data modeling tools, computer hardware and software, data dictionary efforts, and networks required for linking databases for information exchange. An Army-wide M&S Common Data System would be the hub of this infrastructure.

3. Automate Existing Databases. Some Army organizations that have a recognized mission to provide data for M&S do not have automated database management systems in place for their data. Without the use of automated database management systems, it is extremely difficult to develop and maintain data standards for complex technical data to support M&S. Priority should be given to the identification and

automation of these existing databases so that standards development and data interchange can occur in the most efficient manner.

4. Develop Standard Data Models. To develop and maintain data standards for M&S data, it is important to develop standard data models that serve as subject area information models. These subject area information models define terms and formats that can be used as a basis for new database construction and automated data interchange software development.

5. Expand Education. Education includes training, workshops, and data standards consultations. It is important for agencies to remain abreast of ongoing standards projects by conducting and participating in seminars, symposia, newsgroups, and workshops on data and repository standards for M&S applications.

These objectives are the foundation for establishing creditable data standards that will enhance and promote information exchange throughout the Army and across DoD. The validity and flexibility of M&S are contingent upon standard, certified data.

ACCOMPLISHMENTS AND ASSESSMENTS

The Data Standards Category Group meets quarterly to assess requirements and review work. In FY98, a core group of principle players (AMSO, ARL, AMSAA, NGIC, TRAC, CAA, PEO Tactical Missile Systems, the Aberdeen Test Center, and DMSO) was established. This group guides the overall efforts of the category. The group typically works projects of mutual interest using a combination of mission and AMIP funds. Funding amounts are typically about 75% agency funds and 25% AMIP funds.

AMIP co-sponsored an FY98 task with the group to begin development of standard data interchange formats for Characteristics and Performance (C&P) data. The overall goals of this task were to develop a standard C&P subject area of interest model and mappings from AMSAA and NGIC to this model. In doing so, standardized data elements are to be identified and submitted to the DoD Data Dictionary. This project supports Army data standards initiatives by providing common representations for C&P data in Army combat areas. The C&P subject area of interest model can be used as a springboard for mapping other databases to the standard. Once this is complete construction of automated data interchange software can begin. FY99 plans call for integration of TRAC and CAA databases into the standard model. Construction of interchange software is anticipated to begin in late FY99 or early FY00.

The working group initiated a Standard Nomenclature System refine project in FY98. This project leverages the current Standard Nomenclature Database at TRAC-FLVN into a web-based system. Key players in the effort are TRAC, NGIC and AMSAA. These agencies are developing standard naming conventions for platforms (M1A1, M2A2, etc.), munitions (M829A1, TOW, etc.), and weapons (M16, AK-47, etc.) and designing user access tools that comprise the new system. The initial version of the new system will be accessible on SIPRNET in the 4th Quarter FY98 time frame. The system will make the

Standard Nomenclature Database more available to users and increase awareness of its existence.

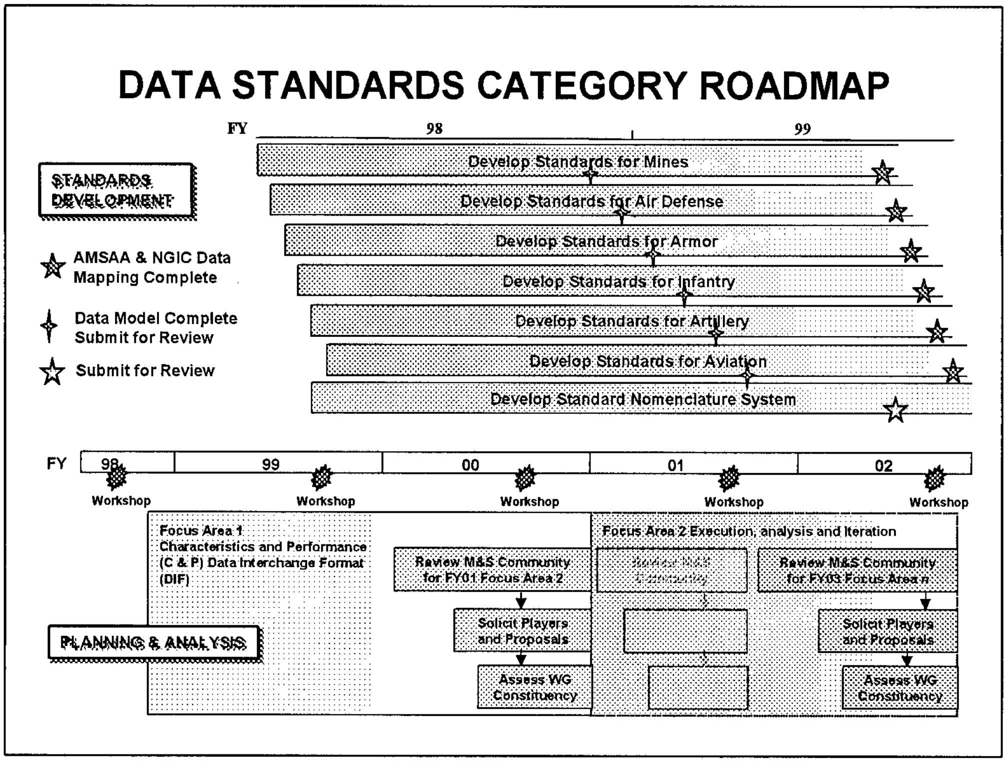
The working group also contributed to the DMSO led Data VV&C "Tiger Team" and authoritative data source efforts. The "Tiger Team" developed data quality definitions, data quality guidelines and associated recommended practices. In support of the Data Technology Working Group's Authoritative Data Sources Subgroup, the data standards group initiated a review of the Army's " Authoritative Data Sources". The current list was reviewed and new sources were solicited. The Army provided assistance in this process.

PRIORITIES FOR NEXT YEAR

The focus of the Data Standards Category for FY99 will be on the continued development and implementation of data standards and the data infrastructure. The focus to date has primarily been oriented towards combat simulation and that will not change for FY99. Successful completion of the standard data interchange format and the standard nomenclature system efforts will put the Army on solid footing in that area. Given those expectations, FY99 and FY00 represent transition years in that the focus will begin to shift from combat simulation to other simulation areas. The Data Standards Category will seek development partners for establishing priorities and conducting projects. More emphasis will be place on education and marketing of the category's products. Tentative plans are to work with DMSO to offer workshops on data modeling and data quality / VV&C. These workshops will also provide a forum for showcasing category efforts and help cultivate new development partners.

ROAD MAP

The vision of the data standards category is to continue identification and development of standards that increase the Army's efficiency in conducting analyses through modeling and simulation. The figure below presents a road map for attaining that vision. As stated previously, the FY99 and FY00 years represent a transition period where significant efforts in the combat simulation area are completed. This focussed nature of development is intentional. By focussing in one area, development partners with common interest can be brought together to tackle multiple issues. It also offers increase opportunity for leveraging mission funds to supplement AMIP funds. The road map calls for a conscious effort to review the working group focus and composition every year. The plan calls for setting the focus one-year ahead of expected project submission. In FY99, the group will set the focus for FY00 and seek development partners for FY00. Pre-planning projects in this manner will allow for better teaming and coordination and should in projects with better community buy-in – and a higher likelihood of successfully developing and implementing effective standards.


DATA STANDARDS CATEGORY ROADMAP
FY
98
99
STANDARDS DEVELOPMENT
AMSAA & NGIC Data Mapping Complete
Data Model Complete Submit for Review
Submit for Review
Develop Standards for Mines
Develop Standards for Air Defense
Develop Standards for Armor
Develop Standards for Infantry
Develop Standards for Artillery
Develop Standards for Aviation
Develop Standard Nomenclature System
FY
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99
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01
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Workshop
Workshop
Workshop
Workshop
Workshop
Focus Area 1
Characteristics and Performance (C & P) Data Interchange Format (DIF)
Review M&S Community for FY01 Focus Area 2
Solicit Players and Proposals
Assess WG Constituency
Focus Area 2 Execution, analysis and Iteration
Review M&S Community for FY03 Focus Area n
Solicit Players and Proposals
Assess WG Constituency
PLANNING & ANALYSIS

Annual Standards Category Report for FY99

DEPLOYMENT AND REDEPLOYMENT

STANDARDS CATEGORY DEFINITION

Deployment and redeployment standards address objects, processes, procedures, techniques, algorithms, data, and other elements needed to accurately portray the relocation of military and civilian forces from the origin to the area of operations, and the preparation for and movement of forces from one area of operations to follow-on designated CONUS or OCONUS bases or areas of operations.

The functional definitions for deployment/redeployment are as follows:

Deployment: The relocation of forces and materiel to desired areas of operations. Deployment encompasses all activities from origin or home station through final destination, specifically including intertheater and intratheater movement legs, staging, and holding areas.

Redeployment: The transfer of a unit, an individual, or supplies deployed in one area to another location within the area, or to the zone of interior for the purpose of further employment.

As a sidenote, DoD has made much progress in the deployment modeling and simulation (M&S) arena that has not yet been extended to the complexities of redeployment. As a result, the following assessment describes deployment only. By setting the standards for deployment, we are inherently developing the standards for redeployment M&S.

STANDARDIZATION REQUIREMENTS/OBJECTIVES

- Develop modeling standards that address all deployment domains (ACR, TEMO, RD&A, execution, planning, analysis, training, etc.) and all the joint end-to-end process elements.
- Develop a common object hierarchy and abstract object model for the representation of all aspects of deployment/transportation, including forces (equipment, personnel, and supplies), transportation assets, cargo, and infrastructure.
- Develop and document deployment related publications, algorithms, heuristics, processes, processes, etc. at various levels of resolution.
- Ensure commonality and linkages with mobilization, logistics, and warfight models and simulations.

ASSESSMENT

The Department of Defense, CINCs, and Services are moving forward to improving the deployment process and standardizing deployment models and simulations. One such inititiative is the Transportation Analysis, Models and Simulations (TAMS) functional process improvement. TAMS is a USTRANSOM Joint Transportation Corporate Information Management Center (JTCC) initiative to assess M&S capabilities currently employed within the DTS. The JTCC has an OSD charter to make recommendations on migration systems. The USTRANSCOM Plans and Policy Directorate TC-J5 sponsored the project. The primary purpose was to recommend a selection of systems to provide an end to end modeling and simulation capability to support the operational components within USTRANSCOM's Global Transportation Network (GTN). The secondary objective of TAMS was to determine functional requirements for the transportation portion of the Joint Simulation System (JSIMS) and Joint Warfare System (JWARS). The TAMS project was initiated to reduce costs of unnecessary redundant functions through systems migration, providing a common set of tools for planning and execution, provide a single transportation answer to queries from all levels, and provide an integrated fort-to-foxhole capability for the areas of Transportation Feasibility Analysis, Programmatic Analysis, and Wargaming. In 1996, USTRANSCOM/JTCC held several workshops to define the current "As-Is" capabilities of deployability M&S. It also held several "To Be" workshops to determine requirements for Transportation Feasbility, Programmatic Analysis, and Wargaming. Participants in the TAMS workshops included USTRANSCOM, the warfighting CINCs, the Joint Staff, OSD, and the Services.

As a result of the TAMS process, JTCC recommended nine Migration Systems currently in use and under development in DoD. These included a desktop system, a shell system, and several other tools that model and simulate various aspects of the Defense Transportation System. These recommended systems have been staffed to the CINCs and Services. After final concurrence, the TAMS recommended Migration Systems will be forwarded to OSD for final approval.

It is not the intent of the Deployment Standards Category to focus primarily on the TAMS Migration Systems or exclude requirements of legacy systems not recommended by TAMS. However, the TAMS systems will provide a good foundation for the development of requirements (and standards) for end-to-end deployment M&S. We will continue to team and invest as necessary to further develop these and other standards and ensure deployment M&S comply with Army and DoD standards such as the HLA.

ACCOMPLISHMENTS

The standards category received AMIP funding in FY 98 and intitiated development of an extensible object hierarchy for deployment models and simulations. This project will evaluate and standardize the object hierarchies and attribute data of existing detailed models and simulations, and extend the hierarchies to other deployment models and simulations. This bottoms-up approach will initially focus on detailed objects and attributes of seaport and installation tools, be applied upward to less detailed tools, and then be used to develop a minimal set of abstract deployment objects.

The standards category is also focusing on standardizing existing publications, databases, and processes currently in use by the deployment M&S community. Some of these products are as follows:

- *Deployment Planning Guide* (MTMCTEA Reference 97-500-5): This guide lists the transportation assets (railcars, aircraft, containers, etc.) needed to deploy Army units during a time-sensitive scenario. It combines equipment characteristics with current unit capabilities and produces generic, rapid planning deployment data.

  - *Logistics Handbook for Strategic Mobility Planning* (MTMCTEA Reference 700-2). This reference provides a broad range of vital transportation information and guidance for planning purposes. It contains general planning considerations and guidelines for each transport mode (motor, rail, sea, and air), containerization data, cargo density information, etc...

  - Load Planning Database. The load planning data was incorporated into FORSCOM's Equipment Characteristics file (ECF) to support the Automated Air Load Planning System (AALPS). AALPS is designed to provide deployment commanders and planners of the joint community an automated means of producing "certifiable" air load manifests. AALPS is certified by the Air Mobility Command (AMC) for C-5, C-130, C-141, and C-17 load planning. In addition to AALPS, this load planning data is also used by the Integrated Computerized Deployment Syatem (ICODES). ICODES uses this data for complex stowplanning of ships. In addition to AALPS and ICODES, this data is also valuable to strategic planners in the deployment of equipment worldwide.

  - TB 55-46-1 STANDARD CHARACTERISTICS (DIMENSIONS, WEIGHT, AND CUBE) FOR TRANSPORTABILITY OF MILITARY VEHICLES AND OTHER OUTSIZE/OVERWEIGHT EQUIPMENT (IN TOE LINE ITEM NUMBER SEQUENCE). This technical bulletin provides dimensions, weight, and cube of military vehicles, vehicle-mounted equipment, and other outsize/overweight equipment. Staff, command and field organizations use these data for standard

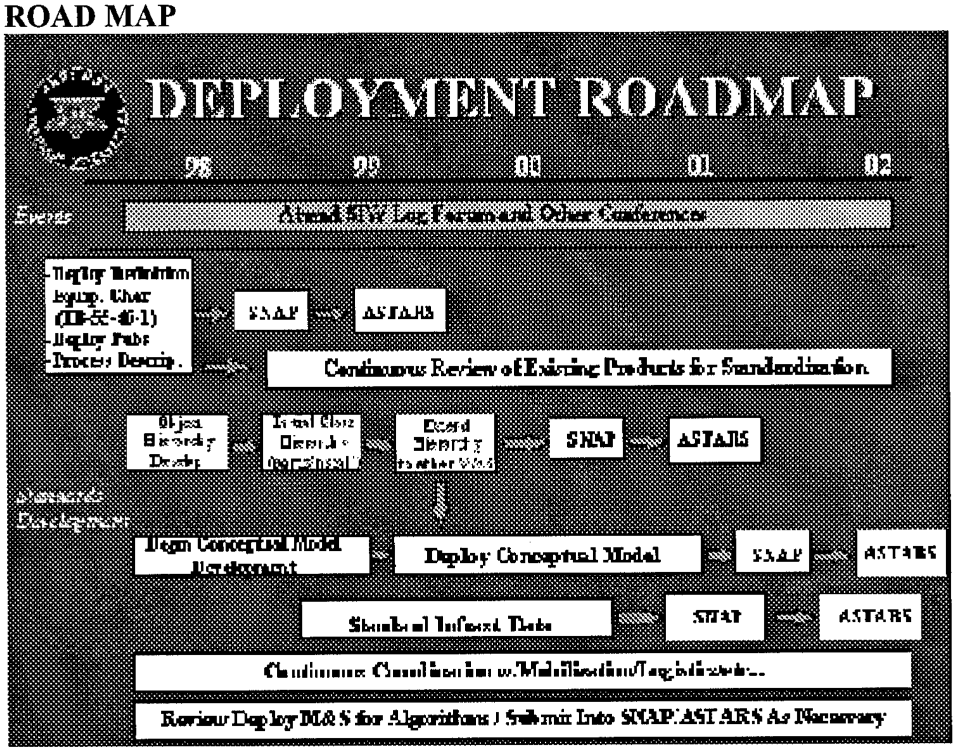
reference in developing and reporting unit movement data. The book is based upon FORSCOM's ECF.

- *Vessel Characteristics for Shiploading* (MTMCTEA PAM 700-4). This publication contains vessel load characteristics for 150 US Flag dry cargo ships. It can be used to provide basic ship characteristics for ship loading and stowage operations.

PRIORITIES FOR NEXT YEAR

The focus for FY99 will be on continual identification of existing products for standardization, including model and simulation algorithms/-heuristics, publications, processes, and databases. We will also continue with the development of the extensible object hierarchy for deployment models and simulations.

ROAD MAP



Annual Standards Category Report for FY99

DYNAMIC ATMOSPHERIC ENVIRONMENTS

STANDARDS CATEGORY DEFINITION

The Dynamic Atmospheric Environments category does not explicitly cover terrain, but it influences terrain in so far as weather effects are concerned. For example, snow cover will change the surface albedo, the amount of rainfall will change the condition of the ground state thereby changing mobility; other examples may be found. Since target acquisition depends heavily on target and background signature propagation through the atmosphere and on diurnal heating effects, background signatures falls under the purview of the Dynamic Atmospheric Environments Category. Target signatures per se, however, are in the domain of the standards category of Acquire.

The battlefield environment includes many sources of aerosols and particulates such as chemical/biological agents, smoke, dust, fog and chaff. These add to the natural environment increasing the presence of non-uniform aerosol regions. Weather, atmospheric transport and diffusion processes, and the attenuating effects of the environment on the propagation of electromagnetic energy all impact target acquisition and high technology weapons. The atmosphere and clouds provide cues, alter target and background signatures, and produce scene clutter both in the real world and in realistic computer-generated simulations. All these weather effects and impacts are in the Dynamic Atmospheric Environments domain and are in harmony with the DoD objective representation of the atmosphere.

Consideration of the above leads us to the definition of the Dynamic Atmospheric Environments category for modeling and simulation (M&S): those objects, algorithms, data, and techniques required to replicate weather, weather effects and impacts, backgrounds, acoustics, and transport and diffusion of aerosols and battle by-products.

STANDARDIZATION REQUIREMENTS

The natural environment is important in determining the outcome of real battles. Included in this area are weather features (clouds, fronts and thunderstorms, etc.) and weather effects such as target contrast changes. However "playing" weather in simulations is currently in its infancy. Meteorological data and weather scenarios are becoming available through efforts such as the Defense Modeling and Simulation Office (DMSO) funded Weather Scenario Generator (WSG), the Master Environmental Library (MEL), and the Total Atmosphere and Ocean Server (TAOS). But converting these meteorological parameters and weather features into quantitative effects and impacts that are not computationally burdening for simulations is a difficult proposition.

Due to the dynamic range of atmospheric processes the Dynamic Atmospheric

Environments category must represent a requirement spectrum ranging from small-scale effects, necessary to correctly visualize scenes, to large-scale aggregated effects, to correctly represent weather impacts. On the small-scale end physics-based calculations, such as the Army Research Laboratory's (ARL) Weather And Visualization Effects for Simulations (WAVES), are needed to represent high fidelity natural and battlefield-induced atmospheric effects (e.g. smoke, illumination, rain/fog, transport and diffusion, etc.), but usually are available only at a high CPU cost. To reduce this burden a scenario-specific natural environmental representation can be pre-computed or pre-scripted (if time-varying) for later real-time simulations. However embedded environmental processes include battlefield-generated clouds, from munitions, vehicles, agents and fires, whose location and time of introduction cannot be completely pre-scripted. They are event-driven, resulting from battle actions and combatant decisions and thus can only partly be pre-computed. These processes are embedded into the natural aerosol environment and are generally more localized and dynamic than other battlefield effects. Atmospheric parameters and effects from embedded processes are thus both super-imposed on and affected by input conditions described by the natural environment representation. In some cases the environmental embedded processes will be the dominant factors in determining the outcome of a simulation.

While progress has been made in this area in recent years, notably in the DARPA Synthetic Theater of War – Synthetic Environments (STOW-SE) program, such efforts require dedicated hardware and pre-computed weather effects scenarios. The underlying models in these simulations are inherently computationally intensive. Engineering level line-of-sight propagation models from ARL's Electro-Optical Systems Atmospheric Effects Library (EOSAEL) and the Air Force Research Laboratory's MODTRAN, while fast, are still burdensome considering the playing area, the potential number of lines-of-sight between entities and the number of pixels needed to generate virtual scenes.

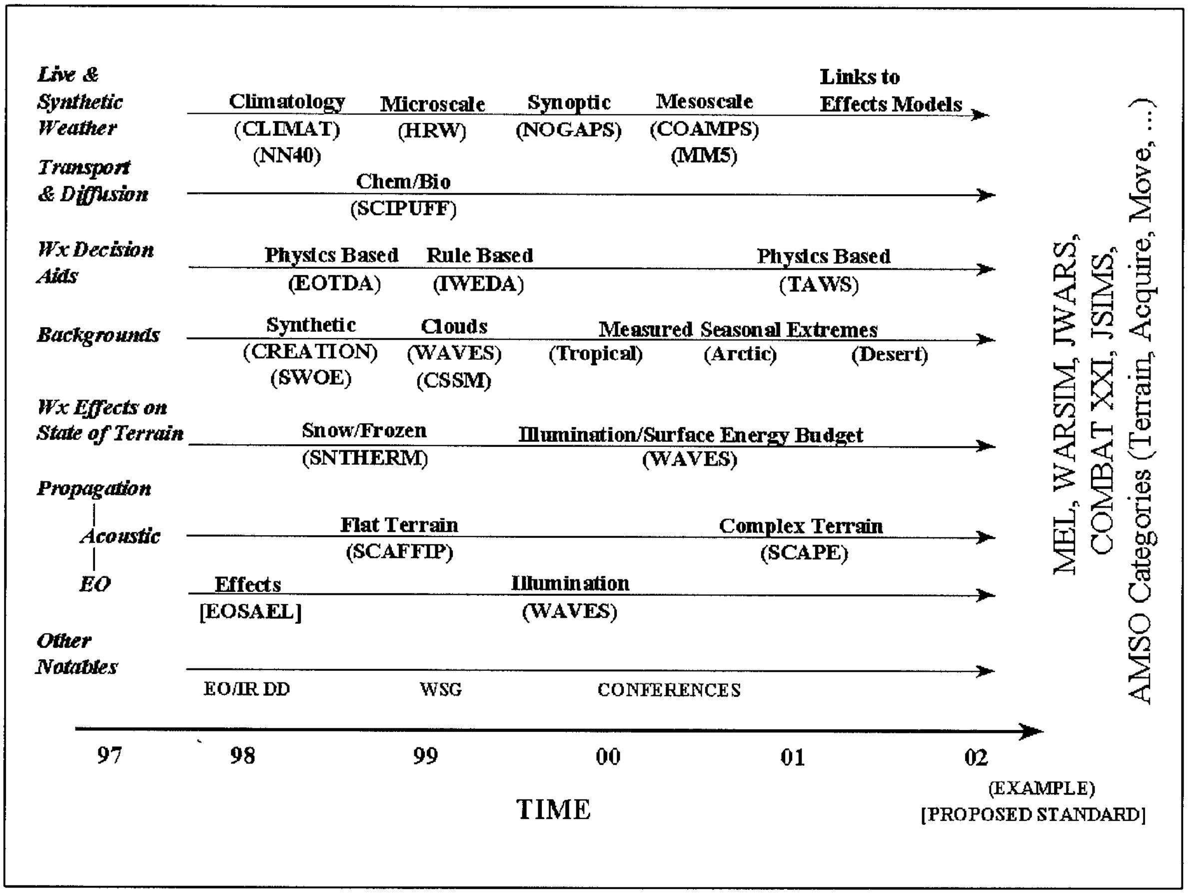
At the other end of the spectrum are the high level simulations that deal with aggregated units. These simulations simply can not afford to include detailed calculations for individual platforms and systems. Thus, a new approach is needed to include weather at a realistic level of fidelity and still maintain "faster than real time" simulation capability. Such an approach may exist in using rule-based programs, such as ARL's Integrated Weather Effects Decision Aid (IWEDA) model. This model, based in Army doctrine, provides color-coded matrix charts showing the impact weather has on various platforms, sensors and weapons systems thereby allowing for simple and fast assessments over large areas without a heavy computational burden. Therefore in order to provide for the disparate needs of both detailed and aggregate simulations DE requirements, presented in Table 1, are general in nature.

Table 1. Dynamic Environments Requirements

Provide Fundamental Environmental Objects for M&S
Provide Consistent Data for Environmental Effects Models
Provide Standardized Databases for System Performance Analysis
Provide Sets of Standard Synthetic Natural Environments

OBJECTIVES

In concert with these requirements the Dynamic Atmospheric Environments category has the objectives of ingesting live meteorological data and real-time forecasts into simulations along with development of: fundamental dynamic environment databases to support M&S; standard synthetic natural environment scenarios and backgrounds; and standard tools to facilitate system performance analyses. Models that currently exist or are under development that will satisfy these objectives are embodied in the Dynamic Atmospheric Environments category roadmap.



ACCOMPLISHMENTS AND ASSESSMENT

Assessment

Modeling efforts leading to the development of standard algorithms in the Dynamic Atmospheric Environments area are, as might be expected, strong in some areas and in need of additional effort in others. EOSAEL is being proposed as a standard in the Dynamic Atmospheric Environments and Acquire categories. EOSAEL was developed initially in 1979 by the ARL's Battlefield Environment Division to quantify the propagation environments expected on battlefields and, as such, is a mature Army code. The Army Modeling and Simulation Office (AMSO) sponsored effort for coupling smoke to the battlefield is the Environmental Effects for Synthetic Test and Training Assessment Ranges (E2STTAR), FY97's Army Modeling Improvement Plan (AMIP) project. The surface energy budget, dependent upon solar flux, is important for determining the ground state and also for dynamic target signatures. This area is currently being expanded by the FY98 AMSO AMIP project, Modeling of the Ground State in Winter Environments (GSWE). Other areas discussed below are the Integrated Meteorological System (IMETS), which provides live tactical weather, the Integrated Weather Effects Decision Aid (IWEDA), a tactical decision aid, the High Resolution 2D and 3D Weather/NBC Modeling and Rendering for Operational Implementation, the DE proposed standard, EOSAEL, and Army contributions to MEL. Additional efforts are needed in/for dynamic target signatures and in weather database development, particularly for standard weather scenarios. These efforts are in concert the DE objectives stated above.

Teaming arrangements for the Dynamic Environments category include members from the Army Research Laboratory, the Army Space and Strategic Defense Command, the Cold Regions Research Engineering Laboratory (CRREL), the Night Vision and Electronic Sensors Directorate, the Yuma Proving Ground and the AMTEC Corp. The report from FY 97's accepted proposal in the AMIP DE category (E2STTAR) will be found below along with an interim report on FY98's accepted proposal (GSWE).

ACCOMPLISHMENTS

ARMY MODELING IMPROVEMENT PROGRAM PROJECTS

Environmental Effects for Synthetic Test and Training Assessment Ranges (E2STTAR)

Objective

The Synthetic Test and Training Assessment Range (STTAR) and Joint Advanced Distributed Simulation integrates live play and constructive simulations for testing, system evaluation and training. The Combat STTAR (CSTTAR), is joint project between the Test and Evaluation Command (TECOM), TRADOC, other Army organizations, and the Navy. The objective of CSTTAR is to infuse virtual intelligence assets into live training at the National Training Center (NTC). In order to do this effectively, it is necessary to include environmental effects such as smoke and dust. This joint effort between TECOM and ARL incorporates a smoke and dust model into CSTTAR which satisfies the requirements to run near real-time and still provides sufficient fidelity for agreement with actual conditions on the live field at the NTC.

Background

ARL has improved methods for visualizing smoke in virtual environments. These were developed by calculating smoke particle densities from the COMBIC model, the DoD de facto smoke model in EOSAEL and used in the Synthetic Theater Of War - Synthetic Environment (STOW-SE) program. ARL represented the smoke puffs as a single, 3D ellipsoidal surface; plumes were then represented as a series of ellipsoids making up the column of the plume. A fractal algorithm is subsequently applied to the surfaces of the ellipsoids allowing for natural appearing variation in the smoke field over time. This produces a high definition smoke cloud for close ranges, and a courser smoke cloud for long range observation. In addition the appearance of the ellipsoids varies with viewing angle and also allows for simulating the billowing of smoke. The use of 3D surfaces extends the 2D billboard techniques used in STOW-SE and provides improved visualization, both from outside the smoke plume looking through it and inside of it looking out. The end result is a smoke cloud that grows, detaches, drifts downwind from the source and finally dissipates.

TECOM worked in parallel on different aspects of smoke insertion into CSTTAR. The first two address different visualization processes within CSTTAR. First is the generation of synthetic UAV imagery that is used by the intelligence staffs and commanders participating in the training exercises. The second is the exercise management displays (stealth viewers) used by controllers during the exercise, and also for mission playback and debriefing after the exercise is completed. The UAV imagery is generated using Silicon Graphic's (SGI) Performer software directly, while the exercise control imagery is based on third-party visualization software that indirectly uses Performer. In order to prevent confusion and provide consistent training, it is important that the UAV and exercise control visualizations provide the same visualization effects.

Summary of Smoke Generation and Visualization

The ARL-TECOM smoke cloud display is a two-step process. First, the smoke cloud is produced pre-simulation and stored for later use during the simulation. Secondly, the smoke cloud is loaded into the simulation and displayed. The smoke plume creation software, SMOKE, creates smoke plumes from the creation of the COMBIC smoke cloud. SMOKE reads data from the COMBIC output files, creates a series of ellipsoids and applies a fractal algorithm to the surfaces of the ellipsoids. The fractal algorithm is used to provide a natural appearing variation in the smoke field over time. The ellipsoids have mean radius and distance from the source determined by the COMBIC output.

The size and density of the polygons in the ellipsoids created by SMOKE vary from 4x4 to 64x64. SMOKE creates a high definition smoke cloud for close ranges, and a courser smoke cloud for long range observation. The appearance of the ellipsoids varies with viewing angle. Because of this, seven smoke clouds are produced for each time step of the animation. These smoke clouds are produced at 0, 45, 90, 135, 180, 225, and 315 degrees. Smoke cloud appearance is highly dependent on the fractal function applied to the average density supplied by the COMBIC model. Five parameters influence the fractal equations, affecting the overall brightness of the smoke cloud and the amount of movement within the smoke cloud, simulating the billowing of smoke. These parameters can be modified by the user to produce the visual appearance desired.

The visualization software, libsmoke, will display a smoke plume created with the SMOKE software. This software is a library of OpenGL functions, which can be integrated into OpenGL and SGI Performer visualization software. Libsmoke displays the smoke plume from the growing stage to the dissipation stage. There are three external functions to the libsmoke library: SmokeInitialize, SmokeInit, and SmokeUpdate.

- SmokeInitialize reads in the smoke plume data created with the SMOKE program, configures the OpenGL graphics, and allocates data structures used in the smoke library.
- SmokeInit creates a smoke cloud during the simulation. Parameters to the function are the world location and orientation of the smoke source.
- SmokeUpdate processes active smoke clouds. It updates the animation time step and extinguishes dissipated smoke plumes. SmokeUpdate should be called for every frame of the simulation.

The smoke visualization software, using fractal ellipsoids, allows the user to walk inside the smoke cloud. This is important for ground based simulations, and is a capability not provided by billboard smoke implementations. The smoke visualization software integrates directly

into SGI Performer. It does not affect frame rate for fewer than 10 smoke plumes on an SGI RE2, or 20 simultaneous smoke plumes on SGI Infinite Reality Graphics.

The CSTTAR UAV simulator is based directly on Performer, allowing direct incorporation of the ARL SMOKE. The UAV simulator was developed by a private contractor, and work is being discussed between ARL and the contractor to incorporate the ARL SMOKE. There are two limiting factors which affect this effort: the effect on frame rate for a large number of plumes, and synchronization with the CSTTAR stealth viewer, as discussed in the next section.

Incorporation of SMOKE into Coryphaeus EasyScene

The CSTTAR stealth viewer is based on Coryphaeus EasyScene, thus incorporation of the ARL SMOKE into CSTTAR required its incorporation into Coryphaeus. In order to incorporate the SMOKE model into Coryphaeus the smoke libraries were incorporated into Perfly, a performer based application; it was necessary to determine where the SMOKE program was attached to the Performer scene tree. Once this was accomplished the same routine was attached with variables changed to represent EasyScene's Performer tree. It was subsequently discovered that the global data was not accessible through the EasyScene tree. This required that the code be modified to pass all necessary operations to the Performer add-on node so that all data necessary for operation was available internally without going through the globals. Setup and initialization still used same global parameters and were unchanged other than a few variable renames/additions.

Upon completion of these steps, comparisons were made between the ARL SMOKE and Coryphaeus smoke. The latter is a feature of Coryphaeus that runs very fast and provides realistic looking smoke. However, the Coryphaeus smoke does not reflect the actual meteorological conditions and therefore can be misleading when used in conjunction with live exercises, as at NTC. Table 2 gives the results of timing comparisons between the ARL SMOKE and Coryphaeus smoke.

Table 2. CSSTAR Timing Comparisons

Smoke Type	**APP**	**CULL**	**DRAW**
ARL Smoke	1.7ms	0.6ms	5.5ms
Coryphaeus Smoke	1.3ms	0.6ms	2.5ms

APP is the application cycle, CULL is the amount of time per frame used to cull out geometry that is not drawn, and DRAW is the actual draw time of each frame. Note that while the APP time is slightly longer for the ARL SMOKE, the DRAW takes more than twice the time of standard Coryphaeus smoke. These times represent a single smoke cloud; each successive cloud would require the same time, leading to large time differences for a

large number of clouds. Due to the added structure and overhead associated Coryphaeus, the number of plumes which can be displayed at full frame rate is lower than the SGI frame rate mentioned previously, and depends on the complexity of the overall simulation.

Conclusions

The ARL code does provide a true physics based representation of the smoke plume, including volume, which can be viewed from any angle and even walked through. This accurate physical representation can increase the value of the training by providing an accurate portrayal of smoke obscuration. However, as the exercise must be executed in real-time, the frame-rate is also critical. On the other hand, the Coryphaeus smoke provides a faster representation of smoke plumes, but the billboarding effect does not allow smoke to be seen directly from above. Furthermore, the obscuration displayed in the visualizations may differ from actual conditions.

The final choice of a smoke model depends on environmental conditions, the size of the exercise and expected quantity of smoke plumes and operational demands on a case-by-case basis. Further trials will be necessary to determine specific criteria. Over time, continued optimization of the code and increased speed of graphics display hardware should eventually allow the improved smoke generation process to be fully incorporated in all cases.

Modeling of the Ground State in Winter Environments (GSWE)

Objective

Cold environments can have drastic effects on Army operations. Current available Army models and simulations have almost no ability to replicate these effects. An inaccurate forecast, or no forecast at all, of the impact of cold environments on Army operations can have a negative effect on training, resulting in inaccurate planning, faulty analysis and subsequent failure of Army operations. The objective is to address the issue of predicting the state of the ground (surface temperature, snow cover, snowmelt, and freeze/thaw depths) by utilizing CRREL's SNTHERM energy balance model. The methodology will investigate the sensitivity of the ground state to different flux model initializations, including a semi-empirical model, a plane parallel model, and ARL's AIM (Atmospheric Illumination Module). Model runs for two locations (Grayling and Yuma), three seasons (spring, fall, and winter), and three sky states (clear, partly cloudy and cloudy) using the three flux model initializations and measured data will be made. The results will be inter-compared, including a comparison with measured ground state information.

Background

It is a well-established fact that the state-of-the-ground is driven in a large part by the downwelling solar and infrared (IR) fluxes. Models developed to predict the state-of-the-ground for Army operations will depend critically on these fluxes for initialization. Unfortunately, these fluxes are not routinely measured parameters as is the case with more common meteorological parameters like temperature, relative humidity, etc. Therefore, indirect methods must be utilized to generate the required flux initialization information for state-of-the-ground models.

CRREL has numerous winter data sets that can be used to initialize both SNTHERM and AIM. One of the more comprehensive data sets was collected during the winter at Grayling, MI, under the Joint Test and Evaluation's Smart Weapons Operability Enhancement program. These data sets also contain the information that can be used as ground truth for the evaluation of the predicted solar and IR fluxes and surface temperatures. Scenarios are also being run for the fall season to investigate the sensitivity of the surface temperature to flux initialization for non-winter environments.

The solar and IR fluxes are being calculated using a semi-empirical scheme developed at CRREL based on the work of Shapiro, a plane parallel scheme using MODTRAN, and AIM. AIM uses the Cloud Scene Simulation Model (CSSM) in conjunction with the Boundary Layer Illumination and Transmission Simulation (BLITS) radiative transfer program to determine the spectral and spatial distribution of fluxes in cloudy and clear atmospheres. Unlike the first two approaches that are either a parameterization or assume a plane parallel atmosphere, BLITS uses a physics based approach that models 3D fluxes through dense clouds.

<u>Status</u>

Case studies for Grayling I, Yuma, and Grayling II have been selected and a database for the desired environmental conditions has been generated. In addition, land surface type digital maps have been prepared and albedo information for each of the land surface types has been generated. Digital copies of these databases have been sent to ARL. The CRREL semi-empirical solar and infrared (based on the work of Shapiro & Wachtmann) models have been modified to provide the desired output for initializing the thermal model. Work is in progress on generating statistics of the spatial variability of the total solar flux over the test regions selected for this effort. These statistics will be generated using both a spatial and temporal technique. The spatial technique involves determining the variability of the total solar flux based on measurements at several locations over the test region, while the temporal technique involves determining the variability of the total solar flux from a time series of measurement at a single location. The length of the time series is based on the wind speed at the cloud level. These statistics will be compared with similar statistics derived from the AIM predicted distribution of total solar flux over the test region. ARL has modified AIM to accept 2 cm^{-1} resolution data. This data is then analyzed in a new routine which processes

the illumination and extinction coefficient data to optimize the choice of bandwidth, mean wavenumber, mean layer transmission, and mean illumination for a series of correlated k-distribution calculations. The object is to divide the spectral data into categories of similar transmission and illumination characteristics rather than similar wavelength alone. This approach reduces the computational burden associated with integrating over a spectral interval. So, for example, all the low transmission regions within a wider band may be processed simultaneously and then all the high transmission regions processed in a second run. The method used to divide the individual 2 cm^{-1} bands into categories involves the computation of a 3D vector for each band. The vectors consist of an illumination dimension, a normalized wavenumber dimension which is also useful in characterizing aerosol and Rayleigh scattering characteristics, and a transmission dimension which measures the average layer transmission for that band. Each 'class' of data is characterized by the data elements included in the class. Means and standard deviations are computed for each class and the class with the largest variance in one of its dimensions is divided. This procedure is followed until a user-selected maximum number of calculation sets is reached. The resulting sets should be optimal for the number of calculations selected. This processing approach was integrated into the AIM front-end code and tested under an initial set of data conditions. In some cases the computations matched the data very well, but more tests will be required to determine whether the resulting code is producing realistic results under most conditions. In particular, the code will be tested next under clear sky conditions and compared with measured Grayling I data. This should indicate whether the input illumination information is realistic. Following those trials we can compare the results with the overcast cases.

OTHER ARMY EFFORTS

The Integrated Meteorological System (IMETS)

The Integrated Meteorological System (IMETS) is the meteorological component of the Intelligence and Electronic Warfare (IEW) sub-element of the Army Battle Command System (ABCS). IMETS provides commanders at all echelons with an automated weather system to receive, process, and disseminate weather observations, forecasts, and weather and environmental effects decision aids to all Battlefield Operating Systems (BOS). IMETS receives weather information from polar-orbiting civilian and defense meteorological satellites, Air Force Global Weather Central, artillery meteorological and remote sensors and civilian forecast centers. IMETS processes and collates forecasts, observations, and climatological data to produce timely and accurate weather products tailored to the specific Warfighter's needs.

The most significant weather and environmental support to Warfighters are the automated tactical decision aids produced by the IMETS. These graphics go beyond briefing the weather by displaying the impact of the weather on current, projected, or even

hypothesized conditions on both friendly and enemy capabilities. Instead of reacting to the weather, the Warfighter then can take advantage of the weather.

IMETS may be used to obtain weather information for simulations and is also critical to the Warfighter's decision making process, because it provides data directly to other force multipliers. The other BOSs in ABCS depend on IMETS to provide the following:

- High resolution satellite images for Intelligence Preparation of the Battlefield (IPB) and terrain analysis
- Near real-time data for safe aviation operations
- Landing/drop zone data for Air Assault/Airborne operations
- Current satellite observations to enhance accuracy of deep fire support systems
- Current and forecasted weather for Combat Service Support planning
- Winds and humidity for Nuclear, Chemical and Biological (NBC) planning
- Communications linkage from DoD and commercial weather satellites and commercial forecast centers to contingency forces

IMETS Block I was fielded to 15 high priority units in FY95/96. The IMETS Block II fielding effort was initiated in FY97. A successful Developmental Test and Operational Assessment was completed in February 97 with the Milestone Decision approved on 15 April 97. On 15 June 98, the IMETS Project office successfully completed a program review in response to Y2K and the Air Force Re-engineering effort. The results of the program review is to initiate a Y2K contingency plan which calls for the removal of fielded non-Y2K compliant processors, the reconfiguration of IMETS to a single processor configuration, and upgrading to IMETS Block II software prior to March 1999.

The Integrated Weather Effects Decision Aid (IWEDA)

The Integrated Weather Effects Decision Aid (IWEDA) is a rule-based weather impact model based on Army doctrine. IWEDA allows for simple and fast assessments over large areas of weather impact factors on units based on their types of platforms, sensors and weapons. IWEDA provides this information to the Army's tactical C4I systems in the form of red-amber-green (unfavorable/ marginal/favorable) 4-D data grids and as common-map overlays. IWEDA is an integral part of IMETS.

IWEDA is being proposed as the basis for a Joint service rule-based tactical decision aid by the Army Intelligence Center. IWEDA includes Army, Air Force, Navy and limited threat systems. Not only is information provided on sensor systems and platforms, but also on other effects of weather, such as impacts on deployment of ground staked antennas due to wind conditions, or temperatures too cold for diesel vehicles to start. IWEDA generates simple red-amber-green tables and overlays. The colors highlight the potential for reduced effectiveness.

IWEDA's approach differs from a physics-based approach in so far as it is based on a large number (approximately 1000) of weather impact "rules". Each system has its list of relevant rules, and each rule definition includes red-amber-green "critical value thresholds" for one of the meteorological parameters that affects the system. These weather impact rules and critical values have been validated through TRADOC organizations, Field Manuals and NGIC for the various systems. IWEDA also includes an interactive rule editor that allows the user to easily modify rules and critical values.

ARL is in the process of coupling IWEDA's rule-based weather impacts with information from physics-based tactical decision aids in order to provide required performance factors and probabilities applicable to aggregated simulations. This effort will then be able to support faster than real-time simulation for more efficient play of weather and at a fidelity comparable to that used in aggregate simulations.

High Resolution 2D and 3D Weather/NBC Modeling and Rendering for Operational Implementation

Weather forecasting and Nuclear/Biological/Chemical (NBC) modeling play a very critical role in having accurate situational awareness in the operational battlefield. The need to have high-resolution weather and NBC forecasts is needed for maintaining accuracy and scalability within the different echelons in the area of operations from the Tactical Operations Center down to the individual platform.

This project is currently being developed by the Battlefield Visualization and Processing Branch of ARL. Its purpose is to develop and implement a high resolution weather and NBC modeling software component that can be integrated into the Army's 3D Virtual Geographic Information System (VGIS) and the Army's 2D C^2I Combat Information Processor (CIP) System. The current design uses a client/server approach, which separates the rendering, computation, and storage modules from the client applications through a set of standard Application Programming Interface (API) procedures. These procedures are used for interfacing into the rendering engines of the 2D CIP and 3D VGIS systems as well as accessing a set of Weather and NBC servers used for computing and storing weather/NBC forecasts and models.

The system is composed of two separate (but not unrelated) entities for weather and NBC applications. The Weather system has a set of five separate modules, which implement a weather forecast server, renderer, client, high-resolution model, and associated parameters and database files. The server module implements the system control and manages the weather forecasts as requested by the different clients in the system. Rendering modules are attached to the display in which the weather data will be shown and provide the rendering algorithms for displaying the different weather data provided by the server. When a new

display is activated (either a CIP or VGIS display) an associated rendering client will also be created which attaches and registers to the server and provides the server with information on the type of data it can render. The weather client is the module, which controls both the server and rendering clients in the system. Rendering requests are sent to the server by the weather client through a standard API control mechanism. Additionally, the client can also control the model module for computing high-resolution forecasts using mesoscale forecasts and terrain as inputs.

For the NBC application, the architecture uses the same module decomposition as the weather server; however, it requires a working weather server for providing the high resolution forecasts needed to perform transport and diffusion computations over the area of interest. A bare bones NBC server has been implemented which has the capability of supplying NBC data polygons for rendering in a 3D environment. An associated NBC rendering client has been developed which uses the VGIS rendering engine for displaying the set of polygons over 3D high-resolution terrain. The NBC plume is displayed as a sequence of semi-transparent polygons as defined by the NBC server. Future work includes creating and implementing the final design for the server and including a computational module, which can support high-resolution terrain inputs.

For the weather application, a 3D rendering client for displaying wind vectors over high resolution terrain as well as low resolution area using the VGIS rendering core has been implemented for both SGI and SUN architectures. A weather server with high resolution modeling capability has also been implemented using the current CIP development architecture standard. This server has the capability of managing large databases for storing weather-related forecasts in mesoscale and high resolution formats. A client for supporting the server and rendering modules has been integrated into the system. The current implementation of the high-resolution forecaster is limited to computing wind vectors over high-resolution terrain using a mesoscale forecast which covers the region of interest with digital elevation terrain supplied by a Digital Terrain Elevation Data (DTED) server. Current work includes enhancing the rendering client to render other weather types supplied by the weather server.

The weather server includes the AirSim high-resolution model for computing environmental effects over the high-resolution terrain. Currently area coverage is limited to the resolution of the terrain and the size of the input grid (set to 200 x 200 points). Forecasts are generated for the same time as is covered by the input mesoscale forecast. In this case, high-resolution forecasts are generated for a 36 hour period in 3 hour increments for a total of 12 individual forecasts.

The Electro-Optical Systems Atmospheric Effects Library

The Electro-Optical Systems Atmospheric Effects Library, EOSAEL, began its development in 1978 and is currently considered a mature code. EOSAEL contains 22

computer modules that can be separated into eight generic classes: (1) atmospheric transmission and radiance (LOWTRAN, UVTRAN, and NMMW), (2) laser propagation (LZTRAN and NOVAE), (3) tactical decision aids (KWIK, GRNADE, COPTER, and MPLUME), (4) battlefield aerosols (COMBIC and FITTE), (5) natural aerosols (XSCALE and CLIMAT), (6) target acquisition (TARGAC), (7) radiative transfer (OVRCST, ILUMA, FASCAT, GSCAT, LASS, REFRAC, NBSCAT, and BITS) and (8) phase function and Mie code support modules. The philosophy underlying the development of EOSAEL has been to include modules that give reasonably accurate results with the minimum in computer time for conditions that may be expected on the battlefield. The latest version of EOSAEL is available to approved users through the Test and Evaluation Community Network Bulletin Board System (TECNET); additional information concerning EOSAEL may be found at http://www.eosael.com. CLIMAT, COMBIC and XSCALE are being proposed as standards in the DE category.

The Master Environmental Library

The Master Environmental Library (MEL), a DMSO sponsored project, is an internet based data discovery and retrieval system (http://mel.dmso.mil/) which provides access to geographically distributed oceanographic, meteorological, terrain, and near space databases. Through MEL users can locate and order environmental information that resides at different United States military and government sites. The mission of MEL is to provide direct and timely access to natural environment information, data, and products, wherever they reside. This includes non-geospatial data such as models, algorithms, and documents, as well as basic environmental data. MEL is currently focused on DoD modeling and simulation users, but is accessible to other DoD, federal, commercial, and academic communities as well.

- For the warfighters, MEL supports a common interoperable view of the battlespace for mission planning, rehearsal, and execution.

- For the DoD decision makers, MEL supports modeling simulation for training, analysis, and acquisition, thereby helping to streamline and optimize these processes.

The participants of the MEL project include operational and R&D agencies from the Air Force, Army, Navy, and DMA. ARL supports a regional MEL site (http://coriolis.arl.mil/) from which various Army meteorological information and models can be accessed. The site contains information on high-resolution field data such as the Dusty InfraRed Test 2 (DIRT2), the Comparison, Evaluation, and Characterization of Army Transmissometer Systems (CECATS), the Wind In Non-uniform Domains (WIND), and the Atmospheric Aerosols & Optics Data Library (AAODL). Also available is information on the Non-hydrostatic Battlefield Forecast Model (N-BFM), a 4D mesoscale model, and the Battlefield Forecast Model (BFM), a hydrostatic 4D mesoscale model. Information is also available on

the High Resolution Wind model (HRW), a mass consistent 2D model, the Canopy flow model (CCSL), the Atmospheric Illumination Model (AIM), which provides radiance and illumination data, and the EOSAEL models XSCALE, which provides information on atmospheric transmission, COMBIC/STATBIC, the Army's de facto smoke models, and CLIMAT, which provides climatological information for 74 regions around the world. The EOSAEL models XSCALE, CLIMAT, and COMBIC are also being proposed as AMSO standards in the Dynamic Atmospheric Environments category this year.

PRIORITIES FOR NEXT YEAR

The priorities for next year include continuing education for the community and the expansion of the team. The need for standard weather scenarios, the improvement of run times for physics based models, and the inclusion of fast running weather impacts algorithms for aggregated simulations are also high priorities for the The Dynamic Atmospheric Environments category.

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Annual Standards Category Report for FY99

FUNCTIONAL DESCRIPTION OF THE BATTLESPACE

INTRODUCTION

The Functional Description of the Battlespace (FDB) offers the potential for increased code re-use, maintainability, and ease of developing and documenting current and future simulations. The Army has developed the FDB since 1994 as a means to enable simulation users to describe Army functionalities on the spectrum of conflict for all echelons. The Working Group consisted of representatives of TRADOC, STRICOM, and industry. The FDB contribution to the SCC program focuses on the simulation development process that are independent of the simulation application. Initial implementation of the proposed policy would be focused on developing guidelines and models for four new simulation developments -- WARSIM 2000, JSIMS, JWARS, OneSAF, and other programs. The FDB categories and their definitions will be based upon Army standards for databases, models and algorithms from the identification of requirements to the storage of validated models and information for simulations.

STANDARDS CATEGORY DEFINITION

The Functional Description of the Battlespace (FDB) Standards Category is defined as the process and the information products that describe Army functions, validated by the user, and stored in a standard way for the use and consistent understanding of simulation developers.

STANDARDIZATION REQUIREMENTS

The FDB Standards Category will address the following:

- development of standard information templates for use by the Army user and simulation developer;
- development of a process that captures validated and traceable standard descriptions of the behaviors, components and characteristics of the Army domain,
- development of policy and procedures for managing Army repository data, models, and algorithms for the simulation developers and users through a seamless knowledge warehouse for current and future simulations and models,
- formation of liaisons between major Army simulation programs and other Standard Categories to encourage use, and updates;
- Standardize a front end analysis methodology and tool for simulation development;
- Explore methods of gathering, sharing and storing database models, data and algorithms for building new models, conducting new processes and establishing standards for reuse on future development programs.

ACCOMPLISHMENTS AND ASSESSMENT

The FDB SCC Team has sought to involve several other SCCs in sharing resources and ideas to promulgate standards development in the Army modeling and simulation community. Meetings with all domain representatives have shown the importance of sharing capabilities and functionality. The FDB SCC has worked with the Logistics SCC to develop information models and a validation process for these products on the FDB.

Working closely with DMSO, JSIMS/JWARS, the FDB SCC Team has found and shared common interests with the MSRR, JCMMS, and DMSO's Conceptual Model of the Mission Space (CMMS). The standard information models (templates) have become the standard within the JCMMS IPT to support the development of JSIMS. The processes developed for the capture and storage FDB products in a repository are being worked collaboratively with the DMSO's CMMS initiative to become a single standard across DOD.

The front end analysis tool used by WARSIM to conduct the Training Requirements Analysis Process (T-RAP) is being ported to Army Systems Approach to Training (ASAT) tool for use by Army trainers.

Attendance at the AMSO Army M&S Standards Workshop on 4-7 May permitted an in-depth review of the FDB SCC's goals and objectives for the next 4 years. Discussions with other SCCs provided key information for all parties concerned to see where collaboration could bring better adoptive standards for the Army. The FDB SCC Team also presented an overview of the FDB to the workshop.

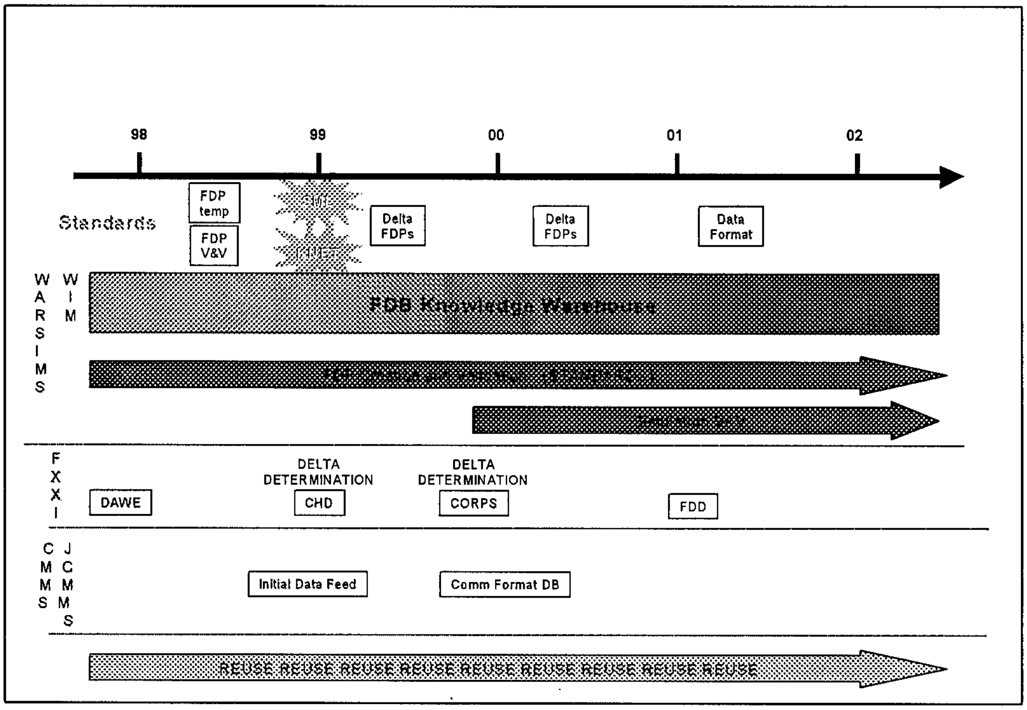
The goal is to promote the use of a common FDB information template, the use of a common architecture for the use of the repository, incorporate identified Army standard algorithms/data, and facilitate model and code reuse.

PRIORITIES FOR NEXT YEAR

Continuing with the current WARSIM 2000 and JSIMS requirements, the FDB SCC Team will nominate the standard information templates used by the JSIMS enterprise, develop new repository methods which are accessible and useful to other SCCs to share their data, models and algorithms. Further collaborative efforts are also planned to enhance modeling and simulation developers. To continue addressing the FDB SC charter, AMIP proposals will be nominated to:

- Standardize a front end analysis methodology and tool for simulation development.
- Demonstrate the feasibility of using the FDB to maintain and develop scenario data and information for building simulation scenarios.

ROAD MAP FOR THE FDB



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Annual Standards Category Report for FY99

LOGISTICS

STANDARDS CATEGORY DEFINITION

This standards category includes the objects, algorithms, data, and processes which model or simulate the initial provisioning, supply, resupply, stockage, facilities, maintenance, and sparing of the ten supply classes, and combat service support (CSS) services provided to and in the field. Army standardization requirements must address M&S support for CSS functions to and in the field.

STANDARDS REQUIREMENTS

The following is a prioritization of the CSS functions (algorithms, processes) that the Working Group deemed appropriate:

1 - Supply - Class III (Bulk)
2 - Supply - Class V
3 - Supply - Class VII
4 - Supply - Class IX
5 - Personnel
6 - Supply - Class I (and water)
7 - Maintenance
8 - Medical
9 – Logistics Description of the Battlespace
10 - Services
11 - Supply - Classes II, III (Pkg), & IV (Construction Material)
12 - Finance
13 - Stockage
14 - Supply - Classes VI and X
15 - Facilities

ACCOMPLISHMENTS AND ASSESSMENT

During the past year, the Working Groups accomplishments were as follows:

a. Completed the review of the second draft of the standard algorithms and the document containing these algorithms.

b. The following is a list of the CSS functional areas for which supply algorithms have been identified and cataloged -

- Class I (Subsistence) and Water

- Class II (General Supplies)
- Class III (Bulk and Packaged POL)
- Class IV (Construction Materials)
- Class V (Ammunition)
- Class VI (Personal Demand Items)
- Class VII (Major End Items)
- Class VIII (Medical Supply - Including Blood)
- Class IX (Repair Parts)
- Stockage (All Classes)
- Maintenance
- Medical (Including Patient Rates, Evacuation Rates, & Hospital Bed Requirements.
- Personnel

c. The majority of the identified algorithms were obtained from three on-going Army programs, the Supply Usage Requirement Estimator (SURE), the Operations Logistics Planner (OPLOGPLN), and the Combat Service Support Control System (CSSCS).

d. Initiated the development of an automated program/data base that can rapidly identify and describe in detail what the essential CSS requirements are that should portrayed in a model or simulation. This project uses the Subject Matter Analysis Retrieval Tool (SMART) from the Functional Description of the Battlespace (FDB) in order to give the CASCOM a unique environment, while maximizing code re-use on the development side. This program/data base is now known as the Logistics Description of the Battlespace (LDB). Currently residing in the LDB are the following: CSS Unit Model Diagrams (UMD) of a typical FSB; CSS Algorithms for stockage, medical evacuation and blood, and supply classes I, II III, and water; and a Task Model for the Supply Company of the FSB. Current support to CASCOM is provided through the Combat Service Support (CSS) index in the FDB document repository as well as through the FDB's CSS Special Interest Group (SIG) in the forum. This provides CASCOM (via the WARSIM FDB) the following capabilities:

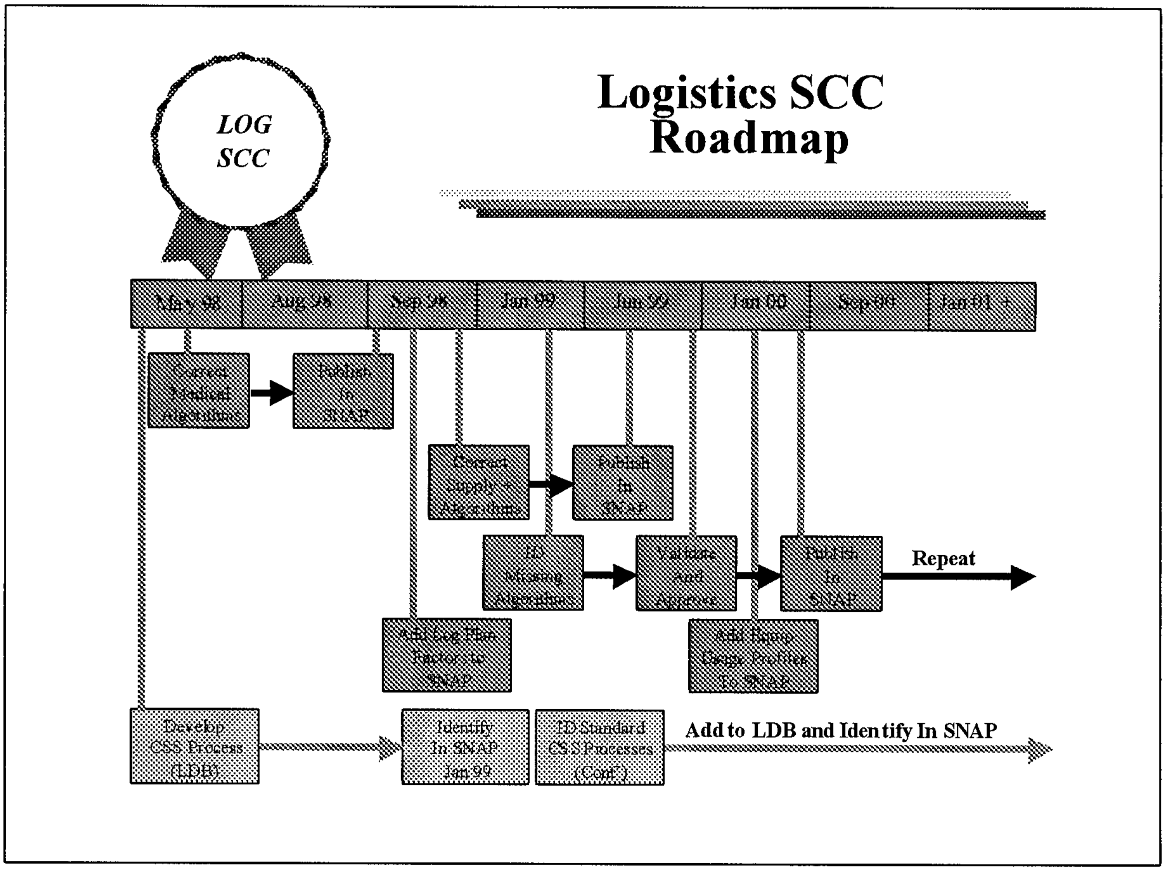
- **Electronic Transmission of Data (via FTP)**
- **Data Conversion**
- **Data Storage**
- **CSS Document Repository**
- **Data Management**
- **CSS Special Interest Group**
- **Traceability of Transactions**

PRIORITIES FOR NEXT YEAR

The following logistics standards will be placed in SNAP/ASTARS as shown below:

Revised Medical Algorithms	4th Quarter, FY98
Logistics Planning Factors	4th Quarter, FY98
Logistics Description of the Battlespace	2nd Quarter, FY99
Revised Supply Algorithms	3rd Quarter, FY99
Revised Stockage, Maintenance, Personnel Algorithms	3rd Quarter, FY99
Equipment Usage Profiles (EUP)	3rd Quarter, FY00

ROADMAP



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Annual Standards Category Report for FY99

MOBILIZATION/DEMOBILIZATION

STANDARDS CATEGORY DEFINITION

MOBILIZATION. Includes the algorithms, objects, and unique modeling techniques needed to accurately portray preparation of forces for military operations and their return, to include:

- Active Units: Unit notification of deployment, unit readiness enhancements (cross-leveling personnel/equipment, personnel soldier readiness processing (SRP), predeployment training)

- Reserve Units: Units receiving Alert/Mobilization Orders, Home Station processing to include cross-leveling, movement to Mobilization Station (MS)/Power Projection Platform (PPP)/Power Support Platform (PSP), unit readiness enhancements (personnel/equipment, SRP, training validation), additional unit training (i.e., E-Brigades to Ft. Irwin).

- Active Duty Individuals: Individual receiving a reassignment order to an installation to be assigned to a deploying unit to fill shortages or to a CONUS Replacement Center (CRC) as an Individual Filler or Casualty Replacement for an OCONUS Theater.

- Reserve Component Individuals (Individual Ready Reserves, Individual Mobilization Augmentees), development of individual requirements, selection and notification of individuals, movement of Reserve Component (RC) individuals to TRADOC for skill validation/skill refresher training, further assignment/movement to a CONUS installation/assignment/movement to CRC for OCONUS deployment.

- The expansion of CONUS/OCONUS installation support facilities to include activation of an installation's MOBTDA.

- Preparation for movement to air port of embarkation (APOE)/sea port of embarkation (SPOE), both personnel and equipment, both unit and nonunit. (Note: movement from PPP/PSP to air port of debarkation (APOD)/sea port of debarkation (SPOD) falls under deployment/redeployment category.)

- Acquisition, processing, and deployment of civilian personnel (to include Department of the Army Civilians (DAC), contractors and other support personnel (i.e. Red Cross) to meet new and increased Army requirements.

- Surge and expansion of the industrial base.

DEMOBILIZATION. Beginning at the Demobilization Station or a CRC to conduct:

- Department of the Army (DA) determination of RC unit/individual requirement to remain on active duty

- RC Units - Demobilization Station processing to include installation support requirements, equipment processing, personnel transition (reverse SRP), issuing demobilization orders, movement of personnel and equipment to Home Station (HS) (separately/together), HS demobilization processing/activities, release from active duty (REFRAD).

- RC Individuals - Arrival at CRC, CRC installation support requirements, personnel and individual equipment deprocessing (reverse SRP), movement to permanent address, REFRAD.

- Reassignment of Active Duty/RC Active Guard Reserve (AGR) individuals from assigned unit to original unit.

STANDARDS REQUIREMENTS

- Standardize algorithms, objects and techniques for modeling mobilization and demobilization
- Provide linkage of mobilization models and simulations to real time data bases

- Ensure commonality with strategic deployment modeling objects and algorithms

ACCOMPLISHMENTS AND ASSESSMENT

FY98 accomplishments of the Mobilization/Demobilization Category consisted primarily of M&S development in different areas of mobilization modeling. Each of the following projects supports the Army *M&S Master Plan* October 1997 M&S Objective 4: "A comprehensive set of standards that facilitates efficient development and use of M&S capabilities," and specifically Sub-Objective 4-3: "Comprehensive set of standards for modeling Army operations and physical phenomenology." While only one of the following projects was funded by AMIP in FY98, all involved work concerning the mobilization functional area and work toward standards development.

- AMIP provided $120K in FY98 funds under the Mobilization/Demobilization Category as partial funding to be used for developing and analyzing mobilization and deployment courses of action (COAs) through a standard decision support tool. The Strategic and Advanced Computing Center (SACC) is presently working to combine the functionality

of FORSCOM's SABRE model and CAA's MARTYR model. The target date for completion of this project is April 1999. Work completed thus far in FY98 includes requirements analysis, architecture design, and initial prototyping. The SACC has adopted the concept of spiral development for building this project. Users of the SABRE program use the application as it is built and provide feedback as necessary for further development. The SACC has established a web site for the SABRE project over the SIPRNET for testing of demos as they are developed. This site has been operational since June 1998. This provides validation of the network on which the program will reside upon completion.

By August 1998, an unclassified SABRE web site will exist that discusses the current development status of the project in terms of requirements, design, and timelines. This site will also link to an unclassified demo of the SABRE prototype. The current prototype available for use already operates through a browser over the SIPRNET. The primary development focus thus far is giving non-technical users the ability to construct and submit complex, ad-hoc queries pertaining to the structure and content of Operations Plans. Our approach is to present terms and phrases that the end user understands, and then dynamically build SQL statements on the fly based on combinations of terms and phrases that the user selects. This mechanism is being tested by actual users. The latest prototype was presented as a demo at the Intelligent and Emerging Technology (IET) 21 conference at Fort McNair in July 1998. Future development will focus on the sourcing engine of this application, which will provide the user the ability to align units to actual force requirements.

- Development of the Mobilization Capabilities Evaluation Model (MOBCEM), which models mobilization activities from Home Station (HS) to Port of Embarkation (POE), continued during FY98. Phase I of three phases of development has been completed and Phase II is in progress. Phase II will complete the Army version of MOBCEM and Phase III will incorporate the mobilization processes of the other services.

  MOBCEM will be an analytical tool which will fill the pre-deployment void in end-to-end modeling systems. The model will provide the capability to simulate mobilization operations and analyze theater capabilities and shortfalls in connection with major force structuring studies. It will also allow for mobilization analysis of capabilities and issues independent of the theater combat models. MOBCEM will include the modeling of Active Component and Reserve Component units, individual personnel, and materiel at all levels of mobilization through full mobilization. When completed, it will allow CAA, the ARSTAF/MACOMs, and OSD to respond to requests for studies/analyses of various aspects of the mobilization process. MOBCEM will be the mobilization component of the OSD Joint Warfighting System (JWARS).

- FORSCOM continues development of the Mobilization and Deployment Capabilities Assurance Project (MADCAP) Integration Management Initiative (MIMI) which allows operational planners to analyze availability of units for onward movement and collective load on Power Projection Platforms/Power Support Platforms (PPPs/PSPs) in a variety of resource categories, i.e., ranges, housing, SRP, etc. MIMI resides under Sun Solaris 2.5.1 and Oracle 7.1.6. It is part of the Global Command and Control System (GCCS) within FORSCOM HQ. MIMI will have to comply with DII COE guidance to continue to be part of the GCCS. High Level Architecture (HLA) compliance is underway.

  In addition, a Joint partnership to improve the deployment process with a MIMI/Joint Flow and Analysis System for Transportation (JFAST) merger is being developed in a two phase project. It will be an NT version. This will provide rapid development and assessment of Time Phased Force Deployment Data (TPFDD) requirements. When completely merged, the resultant product will be fully compliant with the Department of Defense HLA, and will meet requirements for full integration into the GCCS. This merger will provide a more rapid and precise assessment of unit readiness and validation, quick analysis of PPP/PSP capacities and installation out-loading, marshalling area and port throughput capabilities, transportation mode/source selection and allocation for best fit to each contingency, ability to rapidly reconfigure forces to meet fast changing requirements, and ability to quickly assess alternative deployment strategies with stop/start function.

Other category accomplishments included the submission of draft standards to the Standards Nomination and Approval Process (SNAP) and Army Standards Repository System (ASTARS) automated systems for review and approval. The first three draft standards submitted, all mobilization policy documents, were as follows:

- The " Army Mobilization and Operations Planning and Execution System (AMOPES)"
- The "FORSCOM Mobilization and Deployment Planning System (FORMDEPS)"
- The "TRADOC Mobilization and Operations Planning and Execution System (TMOPES)"

The fourth draft standard to be submitted to SNAP/ASTARS by the end of FY98 is:

- Mobilization standard templates for PPP/PSP mobilization activities. The templates will represent all processes that units go through when mobilized. The ultimate goal for use of the templates is to eventually establish standardized objects which comprise the activities represented in the templates.

PRIORITIES FOR NEXT YEAR

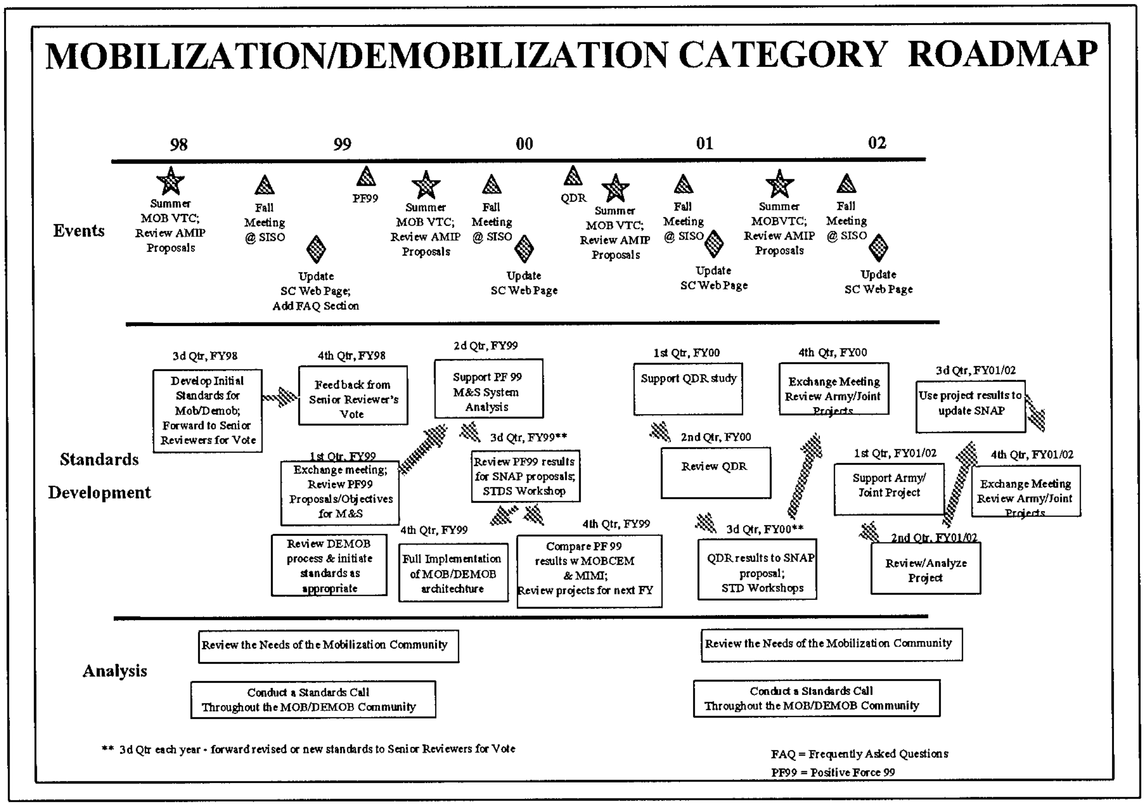
The new five-volume FORMDEPS will contain one volume on demobilization policy. The Mobilization/Demobilization category team plans to undertake a review of the demobilization process and initiate standards related to the process as appropriate.

ROADMAP

The roadmap for the Mobilization/Demobilization category is shown in the figure below. Recurring events are shown across the top band of the chart. These include a summer category meeting or VTC for refining and finalizing AMIP funding proposals, the fall SISO meeting, and a major Army exercise or event involving mobilization, such as Positive Force 99 (PF99) and the Quadrennial Defense Review (QDR).

The middle band of the chart depicts events dealing with standards development. Many of these are recurring as well, e.g., the annual AMSO Standards Workshop and periodic mobilization category exchange meetings set up by the standards category coordinator (SCC). Also included are specific events involving participation in category-related activities, such as support to a mobilization exercise, review and analysis of the results of the exercise, and possible standards development based on the analysis. These events will involve the participation of various organizations represented on the category team.

The band across the bottom of the chart depicts a periodic review of the needs of the mobilization community, including a standards call to the community. This is to ensure that the standards category remains up-to-date on the requirements related to mobilization/demobilization and M&S, and that the needs of the community at large are represented in the category's work towards standards development.


MOBILIZATION/DEMOBILIZATION CATEGORY ROADMAP
98
99
00
01
02
Events
Summer MOB VTC; Review AMIP Proposals
Fall Meeting @ SISO
PF99
Update SC Web Page; Add FAQ Section
Summer MOB VTC; Review AMIP Proposals
Fall Meeting @ SISO
Update SC Web Page
QDR
Summer MOB VTC; Review AMIP Proposals
Fall Meeting @ SISO
Update SC Web Page
Summer MOBVTC; Review AMIP Proposals
Fall Meeting @ SISO
Update SC Web Page
Standards Development
3d Qtr, FY98
Develop Initial Standards for Mob/Demob; Forward to Senior Reviewers for Vote
4th Qtr, FY98
Feedback from Senior Reviewer's Vote
1st Qtr, FY99
Exchange meeting; Review PF99 Proposals/Objectives for M&S
Review DEMOB process & initiate standards as appropriate
2d Qtr, FY99
Support PF 99 M&S System Analysis
3d Qtr, FY99**
Review PF99 results for SNAP proposals; STDS Workshop
4th Qtr, FY99
Full Implementation of MOB/DEMOB architechture
4th Qtr, FY99
Compare PF 99 results w MOBCEM & MIMI; Review projects for next FY
1st Qtr, FY00
Support QDR study
2nd Qtr, FY00
Review QDR
3d Qtr, FY00**
QDR results to SNAP proposal; STD Workshops
4th Qtr, FY00
Exchange Meeting Review Army/Joint Projects
1st Qtr, FY01/02
Support Army/ Joint Project
2nd Qtr, FY01/02
Review/Analyze Project
3d Qtr, FY01/02
Use project results to update SNAP
4th Qtr, FY01/02
Exchange Meeting Review Army/Joint Projects
Analysis
Review the Needs of the Mobilization Community
Conduct a Standards Call Throughout the MOB/DEMOB Community
Review the Needs of the Mobilization Community
Conduct a Standards Call Throughout the MOB/DEMOB Community
** 3d Qtr each year - forward revised or new standards to Senior Reviewers for Vote
FAQ = Frequently Asked Questions
PF99 = Positive Force 99

Annual Standards Category Report for FY99

MOVE

STANDARDS CATEGORY DEFINITION

The MOVE Standards Category encompasses the objects, algorithms, data and techniques necessary to replicate activities that influence land force platform/unit and personnel movement across the battlespace. It also addresses mobility and countermobility as engineer functions, suppression (as a mobility degrader), formations, and dispersion.

STANDARDS REQUIREMENTS

- Land force platform and personnel movement (to include unit movement)
- Mobility and countermobility as engineer functions
- Suppression effects on movement
- Dispersion and formations

ACCOMPLISHMENTS AND ASSESSMENT

- Submitted the NATO Reference Mobility Model (NRMM), Version II, to the Standards Nomination and Approval Process (SNAP) for representation of single vehicle ground movement.

- Completed the *Assessment of Mobility Performance within CCTT SAFOR.* Findings indicated general agreement with proposed NRMM standard; however, the study highlighted the need for inclusion of critical mobility factors to prevent significant over-prediction of mobility potential.

- Began FY 98 project *Air Battle Algorithms – Air Platform Movement.* The study will address modeling required for platform movement capabilities, identify deficiencies, and recommend requirements.

- Began FY 98 project *Standards for Engineer Mobility and Countermobility Operations in Modeling and Simulation.* Results should provide a basis for standard algorithms or tactics, techniques, and procedures for engineer mobility and countermobility representation in M&S.

- Generated high-level of active participation from MOVE Panel membership at the 1998 AMSO M&S Standards Workshop.

PRIORITIES FOR NEXT YEAR

The FY99 research priorities deal with movement for air and ground units and refinement of ground platform movement. The MOVE Standards Category initiatives support Objectives 2 and 4 as outlined in the October 1997 Army Model and Simulation (M&S) Master Plan. Potential standards for combat engineer functions in mobility/countermobility are expected products of an FY98 study. Standards for unit formation and movement, including logistical movement, will be investigated in FY98 and FY99 proposed efforts. Progression of the NATO Reference Mobility Model (NRMM) through the SNAP will be tracked by MOVE during the upcoming fiscal year. A listing of the priorities follows.

- Formations (Air, Ground)
- Logistical Movement Standard
- Platform Movement
- Mobility/Countermobility
- Aircraft

ROADMAP

In accordance with the October 1997 Army Model and Simulation (M&S) Master Plan, the top three MOVE Standards Category proposals were submitted for consideration for FY99 funding:

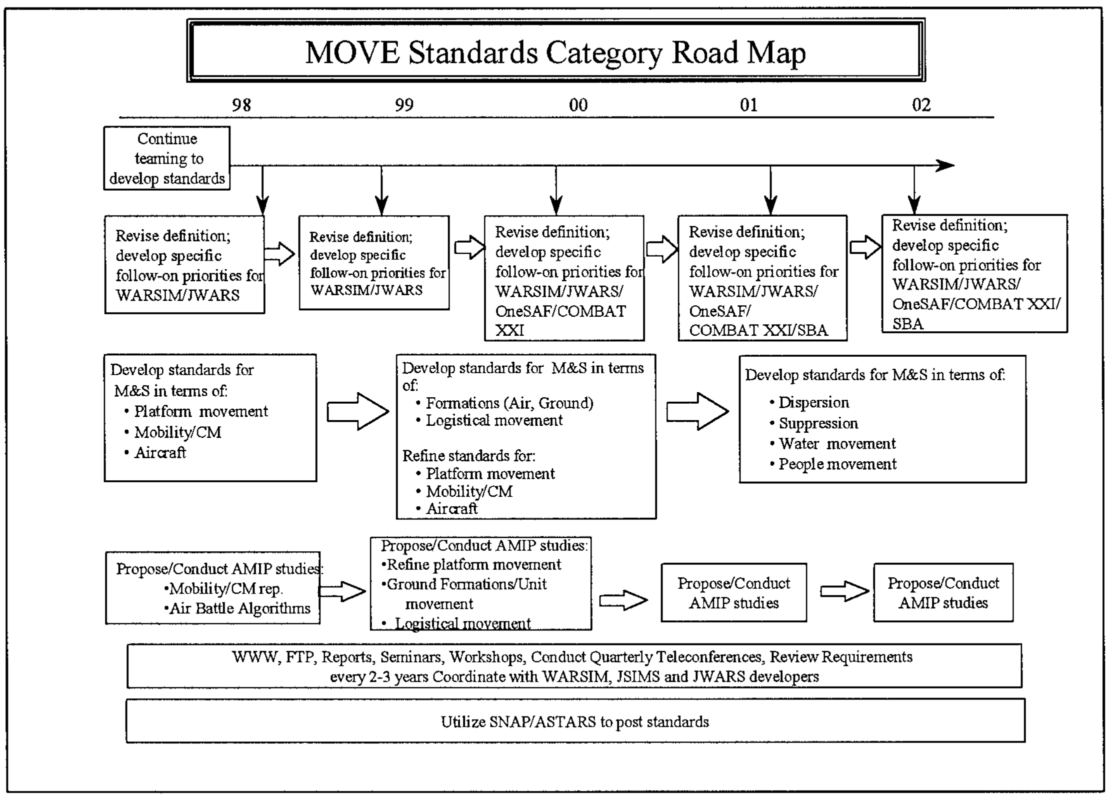
Extended Air Defense Simulation (EADSIM) Ground Mobility Enhancements: The work to be performed will provide an expanded set of ground entity movement in EADSIM and provide a common method for specifying unit formation movement that can be used in several new models including JWARS and JSIMS. Executing Agency: US Army Space & Missile Defense Command.

Development of Aggregation/Disaggregation Standards for On-Road/Off-Road Logistical Movement in Theater-Level Warfare Simulations. The goal is to provide a standard for aggregating/disaggregating arcs in network representation for logistical movement in theater-level warfare simulations (i.e. JWARS, JSIMS). Executing Agency: US Army Engineer Waterways Experiment Station.

Enhancements to the NATO Reference Mobility Model II (NRMM II). Refinement of NRMM II is needed to enhance portrayal of obstacle crossing/interference, wheel sinkage, and vehicle articulation to accurately predict design performance required for Simulation Based Acquisition.

These proposed efforts support the development of standards identified by MOVE for the near term. Coordination with other Standards Categories is considered essential in the

execution of MOVE initiatives and will be carried out through teleconferences and meetings such as the annual AMSO M&S Standards Workshop. At the FY98 workshop, coordination/interaction between other Standards Categories, including LOGISTICS and TERRAIN, enhanced resulting proposals and roadmap development. The roadmap for MOVE is shown below. Support to JWARS, JSIMS, and WARSIM 2000 are central to the outlined progression.



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Annual Standards Category Report for FY99

OBJECT MANAGEMENT

STANDARDS CATEGORY DEFINITION

Object management is defined as the process that develops abstract object classes and methods that are

- Consistent in their representation of object attributes/methods;
- Applicable to 95% of the M&S employing them;
- Accepted by the M&S community, and;
- Interoperable at levels allowed by their model environment.

STANDARDS REQUIREMENTS

The Object Management Standards Category (OMSC) will address the following:

- Development of definitions of abstract object classes for Army use
- Development of policy and procedures for managing Army objects
- Formation of liaisons between major Army simulations and other Standard Categorers to encourage use, updates, and expansion of object classes
- Explorations of methods for gathering, sharing, and storing metadata about standard objects.

ACCOMPLISHMENTS AND ASSESSMENT

The OMSC conducted a review, testing, and revision of the Platform Object and Unit Object for nomination as an Army object standard. Additionally, the OMSC developed the Location Object and the Data Object. The Environment Object development, comprised of a Terrain Object, Atmosphere Object, Space Object, and Ocean Object, was initiated. Also initiated was a framework that defines the behaviors required in M&S and the development of an approach to integrate the behaviors into objects.

The following is a synopsis of the OMSC's FY98 accomplishments:

- <u>Platform Object</u>. Using the component-based approach developed by the Standard Army Model and Simulation Objects (SAMSO) Study, the OMSC reviewed the SAMSO study approach and output related to the draft Platform Object. To explore the capability of the Platform Object to address expected M&S platform implementation; the OMSC conducted a number of M&S test applications. The simulations chosen for the test applications were the AMSAA Groundwars simulation and the TRAC-WSMR

CASTFOREM/COMBAT XXI simulation. Additionally, to gain a broader perspective on the application of the draft Platform Object to other M&S domains, an overview of the draft Platform Object was provided to the Army M&S Management Program Working Group (AMSMP WG) and the Army M&S Standard Categories for review. Comments were collected to determine changes necessary to the Platform Object needed to address differing M&S requirements. Based on the review and application to a set of M&S, an updated version of the draft SAMSO Platform Object was developed and submitted to the Standards Nomination and Approval Process (SNAP) and the Army Standards Repository System (ASTARS). A report was written that documented the SAMSO study results; the test applications using Groundwars and CASTFOREM/COMBAT XXI; crosswalk with WARSIM 2000 and the Logistics SC set of combat simulation requirements; and the final set of Platform Object components, methods, and definitions.

- Unit Object. As performed for the Platform Object, the OMSC reviewed the SAMSO study approach and output related to the draft Unit Object. To explore the capability of the Unit Object to address expected M&S implementation; the OMSC conducted an M&S test application. The simulation chosen for the test application was the TRAC-FLVN AWARS simulation. Additionally, to gain a broader perspective on the application of the draft Unit Object to other M&S domains, an overview of the draft Unit Object was provided to the Army M&S Management Program Working Group (AMSMP WG) and the Army M&S Standard Categories for review. Comments were collected to determine changes necessary to the Unit Object needed to address differing M&S requirements. Based on the review and M&S application, an updated version of the draft SAMSO Unit Object was developed and submitted to the Standards Nomination and Approval Process (SNAP) and the Army Standards Repository System (ASTARS). A report was written that documented the SAMSO study results; the test applications AWARS; crosswalk with WARSIM 2000, ARES, and the Logistics SC set of combat simulation requirements; and the final set of Unit Object components, methods, and definitions.

- Location Object. This object consists of the Local Object and the LatLon Object. The notion of location is fundamental to most military simulations. There are numerous coordinate systems used in simulation, each appropriate for some simulations and not suitable for others. A common, abstract location object can foster interoperability among simulations that use different coordinate schemes. A report was drafted to define the objects, object methods, and object definitions.
  - Data Object: This object consists of the Data Requestor, Data Collector, and Data Event Listener. This object allows the M&S user to use a general data services that can be tailored to address unique study analysis data requirements. A report was drafted to define the objects, object methods, and object definitions.

- Environmental Object. An Environment Object was defined to represent the overall environment is which the simulation would transpire. The Environment Object is comprised of a Terrain Object, Atmosphere Object, Space Object, and Ocean Object. The OMSC initiated development of the Terrain Object and the object methods that are considered the minimum essential to represent terrain.

- Behavior Framework/Object Integration. Sophisticated modeling of combat requires the ability of the simulation to allow model entities with the capability to react to induce stimuli when it occurs. The OMSC initiated the development of a framework to define the behavior actions necessary for simulations to model combat entities. This framework will include the classification and integration of combat behaviors, from individual soldiers up to command level, into Army standard objects (i.e., elemental instruction sets, combat instruction sets, and command decision modeling sets)

- Website Development. The OMSC created a website that lists the relevant documentation and briefings associated with FY97/98 object development.

PRIORITIES FOR NEXT YEAR

The following are OMSC priority activities for FY99:

- Behavior Framework/Object Integration. As initiated in FY98, the OMSC will continue the classification and integration of combat behaviors, from individual soldiers up to command level, into Army standard objects (i.e., elemental instruction sets, combat instruction sets, and command decision modeling sets)

- Environment Object. In addition to the completion of the Terrain Object, the OMSC will continue development of the Environment Object by developing the Atmosphere Object, Space Object, and Ocean Object

- Simulation Services Objects. This object class represents functions such as the Simulation Engine, Simulation Management, Event Mangers, etc. The OMSC will develop a list of Simulation Services Objects that require standardization and initiate development of high-priority standards.

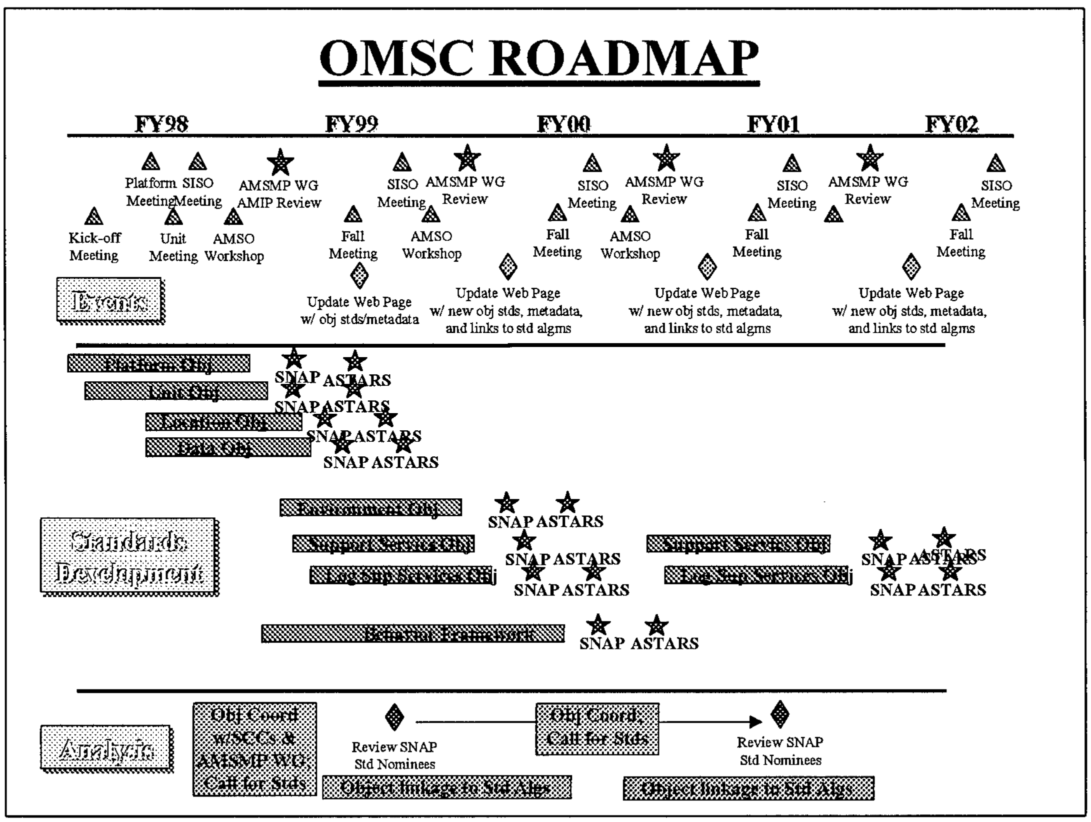
- Logistics Support Services Objects. This object class represents the modeling of assembly points, maintenance facilities, etc. The OMSC will develop a list of Logistics Support Services Objects that require standardization and initiate development of high-priority standards.

- Linkage of Platform and Unit Object Methods to Standard Algorithms. This activity will provide documentation on the standard algorithms and algorithm sources necessary to execute the Platform and Unit object methods. If standard algorithms cannot be found, a SNAP Standard Requirement Document will be submitted.

- Sample Execution of the Platform and Unit Objects in a Simulation Environment. This exercise will select and build a sample OO simulation using the standard objects to ensure that the minimal essential set of object elements is defined.

- Updated Website. This activity will revise the existing OMSC website to list objects, object methods, object definitions, and standard algorithm references in a easily navigable manner.

ROADMAP



Annual Standards Category Report for FY99

SEMI-AUTOMATED FORCES (SAF)

STANDARDS CATEGORY DEFINITION

Software integration that produces realistic entities in synthetic environments that interface appropriately with live, constructive, virtual, and simulator entities, but that are generated, controlled, and directed by computer software.

STANDARDS REQUIREMENTS

1. Develop SAF standards that are useful in all M&S domains, applicable to distributed simulations, representative from single entity to corps, and useful in a joint environment.
2. Minimize operator overhead for SAF.
3. Ensure structures and data bases are modular and easily isolated.
4. Provide consistent representation for battlefield systems, and unit tactical/doctrinal behaviors in all SA
5. Support the development of the High Level Architecture.
6. Provide useful standards to current and future entity based model developments.

ACCOMPLISHMENTS AND ASSESSMENT

1. *Operational Requirements Document (ORD) approved for the OneSAF model* During FY 98, TRADOC officially approved the requirements for the development of the OneSAF model. The model will replace ModSAF, Janus, and CCTT SAF capabilities. Though underfunded, a funding line was established within the POM to support the OneSAF development.

2. *The Army Model Simulation Executive Council (AMSEC) approved an evolutionary approach to the OneSAF development, while supporting the continuing research and development necessary for an eventual objective architecture for OneSAF* The AMSEC recognized the need for an affordable solution to current SAF needs within the Army, and approved the OneSAF IPT 's recommendation to continue research into a long term solution of a new SAF architecture. As a short term solution, an Operational Test Bed (OTB) will be based on ModSAF and matured to meet the needs of current customers such as WARSIM. In the meantime, an Architecture IPT is developing operational concepts that address the more difficult OneSAF requirements of terrain, object, and behavior composability.

3. *Initial research is begun in object design and development for COMBAT XXI and OneSAF.* TRAC-WSMR, in conjunction with the Army SCC for Object Management, has begun the high level design of unit objects for COMBAT XXI and OneSAF. Using

common objects will promote interoperability between the human-in-the-loop OneSAF model and the closed form COMBAT XXI model. This is extremely important to the analytical community.

4. *Draft standards are introduced for the SAF category.* Draft standards have been entered into the SNAPS and ASTARS system for the following Combat Instruction Sets (CIS): React to Indirect Fire and Hasty Occupation of a Battle Position. These CISs have been implemented in both CCTT SAF and ModSAF, and will increase behavioral interoperability between the two SAFs. These CISs will also be used in the OneSAF Operational Test Bed, and will provide a basis for a common behavior standard for the OneSAF objective system, that will replace CCTT SAF in FY04.

5. *A much improved ModSAF Version 4.0 is released.* ModSAF Version 4.0 was released in May, 1998, and shows great improvement over Version 3.0. This version was tested more strenuously than any previous version and underwent a landmark Government Acceptance Test (GAT). The V&V of this version, though still not to the level defined by DA PAM 5-11, was also much improved.

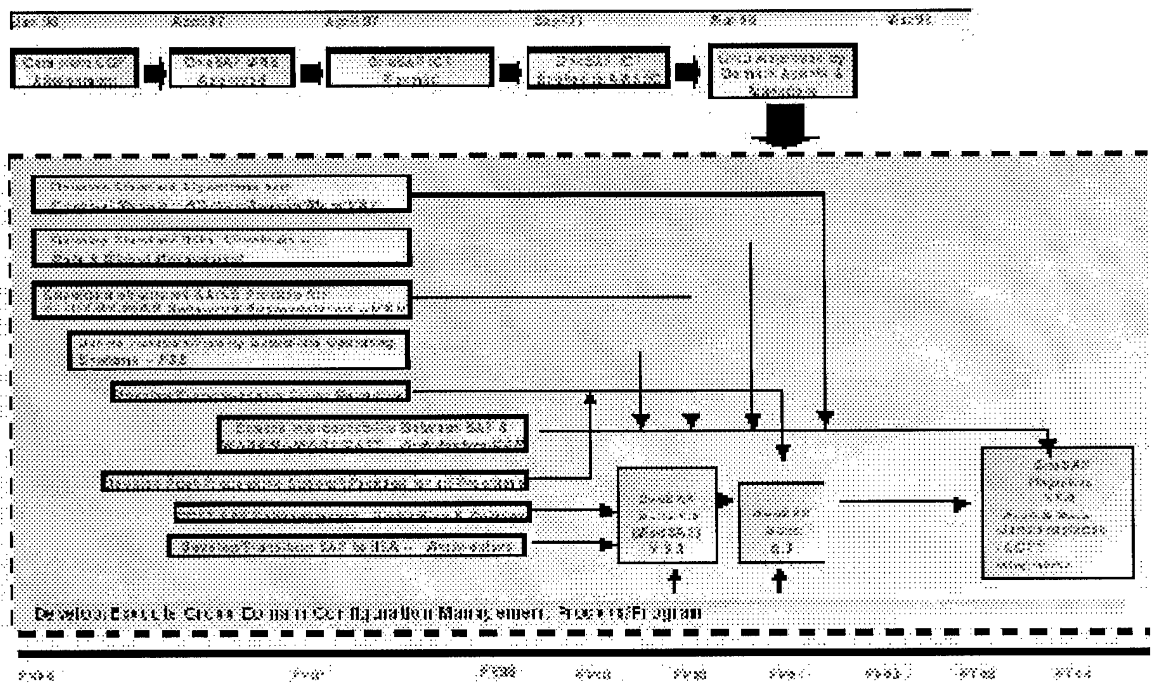
PRIORITIES FOR NEXT YEAR

1. *Development of definitions of combat primitive behaviors.* This is important for the development of OneSAF, WARSIM, and COMBAT XXI. A common definition of primitive level tasks will facilitate interoperability between entity level M&S.

2. *Development of a technology to enhance terrain data base interoperability between SAFs.* The OneSAF ORD requires the ability to accept terrain data bases of different formats. In order to accomplish this level of terrain composability, an Application Programmer's Interface (API) must be developed that will convert data from a single source to different types of runtime representations.

3. *Continued research into areas of technology research such as object, behavior, and terrain composability.* To develop the next generation architecture for SAFs, important research must be conducted in these areas of composability. Users in the various M&S domains demand this sort of flexibility for development of varied fidelity scenarios.

ROADMAP


Develop/Execute Cross Domain Configuration Management Process/Program

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Annual Standards Category Report for FY99
TERRAIN

STANDARDS CATEGORY DEFINITION

The Terrain category includes the objects, algorithms, data, and techniques required to represent terrain and dynamic terrain processes in modeling and simulation.

TERRAIN (STATIC AND DYNAMIC) DEFINITION

Dynamic terrain allows for terrain changes to be introduced during a simulation. Examples include earth moving, weather, and cratering due to weapon effects. In contrast, static terrain does not change after a simulation has been started.

STANDARDS REQUIREMENTS

The standardization objectives of the Terrain category include:

1. Defining geospatial information content, resolution and accuracy requirements for developmental models and simulations.
2. Determine correlated terrain databases.
3. Determine standards for rapid terrain database generation.
4. Determine standards for representing dynamic terrain.
5. Determine a consensus based data exchange standard.
6. Encourage use of standard repositories (SNAP, ASTARS, MSRR, &MEL).
7. Coordination with other Standard Categories closely coupled with Terrain.

ACCOMPLISHMENTS AND ASSESSMENT

A number of Army and DoD investment programs exist to support the standards development process and the development and transfer of emerging M&S technologies. These programs include the Army Model Improvement Program (AMIP) and Simulation Technology (SIMTECH) programs. The Defense Modeling and Simulation Office (DMSO) through the M&S EAs for Terrain, Oceans, and Atmosphere also funds studies and projects that support DoD M&S objectives. Due to limited funds, only a small number of projects are funded each year from these investment programs. Despite the lack of AMIP funding for Terrain category projects in recent years, TEC, NIMA, the Defense Advanced Research Projects Agency (DARPA), and others continue to dedicate declining resources to vital research and development efforts that are attempting to address stated Army and DoD M&S terrain and functional capability requirements. Specific requirements identified by the Army

include: (1) realistic 3D terrain representations, (2) correlated terrain databases, (3) standard terrain databases, (4) dynamic terrain features, (5) techniques for rapid terrain generation, and (6) realistic soil and feature properties.

Accomplishments

The following AMIP, SIMTECH, and DMSO studies and projects were concluded in FY96:

1. ***High Resolution Terrain Study.*** This study was initiated to answer specific questions concerning the impact of terrain resolution on data ownership, or the costs associated with the production, use, storage, and transmission of high resolution data. The study also sought to quantify the effects of high-resolution terrain data on battle outcomes in constructive models such as Janus, and virtual simulations like the Close Combat Tactical Trainer (CCTT).

2. ***Synthetic Terrain Integration and Construction System Implementation Report.*** This study was initiated to develop a design concept for an integrated production system to generate Interim Terrain Data (ITD) and Digital Terrain Elevation Data (DTED) products. The recommendations from this study were intended to assist TEC's Operations Division (OD) in integrating its commercial hardware and software assets with an interface designed to lead terrain analysts through the creation and exportation of standardized data products needed to support M&S applications. Army Directive 93059360, Digital Topographic Data (DTD) Requirements for Army Modeling and Simulation (M&S), 13 Aug 93, challenges TEC to become a co-producer of ITD and DTED to support the Army M&S community. NIMA has recognized the same need for an off-line production capability based on Commercial Off-The-Shelf (COTS) hardware and software and has initiated a Distributed Terrain Data Test Bed Facility effort in conjunction with TEC OD and the Institute for Defense Analysis (IDA) to develop a STICS like prototype production capability.

3. ***Neural Net Prototype to Generate M&S Terrain Databases.*** The purpose of this project was to develop a stand alone system based on rapid prototyping designs that integrates JPL artificial neural network technologies and image processing techniques to produce vector formatted terrain files (e.g., transportation, surface drainage, vegetation, and urban area delineation) from NIMA Arc Digitized Raster Graphics (ADRG). Due to the unexpected departure of two key JPL project scientists involved in this developmental effort, JPL was not able to complete the project and deliver the neural net software and final report to TEC for evaluation and testing in August 1996. Despite this set back, Lockheed Martin/Loral has developed and marketed a similar product with the same functionality. Initial evaluations of this software package reveal it to be a robust product for rapidly converting raster map information into usable vector formatted terrain data.
4. ***DIS Terrain Data Format Study.*** The purpose of this report was to provide descriptions and comparisons of existing and developing standard DTD and Distributed Interactive

Simulation (DIS) terrain data exchange formats in the context of general DIS community requirements for terrain data. An analysis of these formats was made to determine each format s key features and its ability to support the DIS community. Each format was examined relative to the support that it provides for each of the following key characteristics: metadata; topology, ranging from Level 0 (none) to Level 3 (full topology support); spatial organization and indexing; feature and attribute coding; text; composite features; integration and/or layering; multiple levels of detail; 3D data; 3D model behaviors; and, coordinate systems and datums. The results of this study identified key spatial data modeling and representation concepts provided by these formats which should be included in future synthetic environment data interchange standards.

5. ***Analysis of Digital Topographic Data (DTD) Issues in Support of Synthetic Environment Terrain Database Generation.*** The purpose of this report was to examine the use of DTD in the generation of synthetic environment terrain databases, with the goal of identifying enhancements to the current NIMA DTD formats and products that would facilitate the synthetic environment terrain database generation process. The report describes six synthetic environment terrain database generation systems, focusing on their use of current DTD formats and products; identifies a number of issues related to the use of DTD in synthetic environment terrain database generation; and describes a general framework for synthetic environment terrain database requirements, addressing mobility, sensor simulation, and terrain reasoning, as well as visual image generation.

The following AMIP, SIMTECH, and DMSO studies and projects were concluded in FY97 and FY98:

1. ***Geospatial Data for the 21st Century Land Warrior Videotape.*** To sensitize Army planners and users to the level of effort, time, and resources required to satisfy Army high resolution terrain data requirements in an era of declining resources, rapid change, and a global land combat mission, GID produced an educational videotape in FY97 entitled "Geospatial Information for the 21st Century Land Warrior." This videotape will also educate the Army Warfighter and user community to the changes currently underway within the Geospatial Information and Services community; to the information and services that can be expected in the future; to the processes for stating terrain requirements; and to the challenges that remain for satisfying very high resolution terrain requirements to support all applications as the Army moves into the next century.

2. ***Standard Algorithms for Environment/Terrain Project.*** This Verification, Validation, and Accreditation (VV&A) AMIP project was funded in FY97 to catalog environment and terrain algorithms for reuse within the M&S community. The catalog contains information on algorithms that reasonably model or simulate dynamic environment and terrain processes. TRAC POC: Ms. Susan Solick at solicks@trac.army.mil.

3. ***Line-of-Sight (LOS) Reuse Study.*** The goal of this TEC study was to develop a frame work (i.e., documentation standards, software tools, data sets, procedures) that can be used to verify and validate several LOS methods being used by the Army and to install this software into the Army Reuse Center (ARC) Mapping, Charting and Geodesy (MC&G) software reuse library.

Related Activities Assessment

In addition to the studies and projects previously mentioned, the following related activities reflect vital research and development efforts that are attempting to address stated Army and DoD M&S terrain and functional capability requirements.

- ***Synthetic Theater of War (STOW) 97.*** STOW97 was an Advanced Concept Technology Demonstration (ACTD) jointly sponsored by DARPA and the United States Atlantic Command (USACOM). TEC's Topographic Research Division, formerly the Topographic Applications Laboratory, executed the SE STOW program, under the direction of DARPA's SE Program manager. The STOW program sought to demonstrate technologies enabling the integration of warfighting with: (1) live instrumented simulation ranges, (2) manned virtual simulators, and (3) constructive simulations from geographically distributed locations into a common synthetic battlespace. STOW97 program components included:

- ***Dynamic Virtual Worlds (DVW).*** DVW integrates environmental feature models within the Modular Semi-Automated Forces (ModSAF), and complementary real-time visualization systems, currently Loral's Vistaworks and Silicon Graphics' Performer. Key feature models being integrated include battlefield smoke, atmospheric transmittance, time of day, shadowing, signal and illumination flares, vehicle dust, clouds, thunderstorms, precipitation, dust clouds, explosions and weapon effects, trafficability and mobility, and hydrologic modeling.

- ***Dynamic Terrain and Objects (DTO).*** DTO integrates dynamic terrain and object capabilities in ModSAF, and complementary real-time visualization systems, currently Loral's Vistaworks and Silicon Graphics' Performer. Two basic levels of dynamic terrain and objects are supported. Level 1 supports changes in terrain databases or object geometry during simulation run-time. Requirements for Level 1 dynamic terrain are focused on combat engineering requirements to include cratering, minefield breaching, anti-tank ditch breaching, and breaching of other combat employed obstacles. Level 2 dynamic terrain supports multi-state objects which have potential for instantiating a variety of health or damage states (i.e., healthy bridge, damaged bridge, destroyed bridge). The first generation of dynamic terrain includes scatterable and standard emplaced mines and minefields, road craters, anti-tank ditches, obstacles, survivability positions, bridge demolitions, highway overpass demolitions, and railroad demolitions.

- ***Integrated Computer Generated Forces Terrain Database (ICTDB).*** ICTDB represents a new capability in terrain database representation. This new representation accommodates multiple data sources with integrated feature and elevation data. Extended terrain feature attributes include attributes for weather effects. Multiple elevation surfaces, such as the ocean surface over the ocean floor, caves, tunnels, and buildings are supported. Aggregated features support maneuver by higher echelons. The ICTDB supports a global coordinate reference system is designed to facilitate real-time terrain updates. This new terrain database representation will support significantly more environmental effects than are now available to Computer Generated Forces (CGF) systems, and will allow for improved interoperability among virtual and constructive simulations.

- ***STOW Terrain Databases (TDBs).*** The STOW program developed a suite of advanced TDBs that satisfy high, medium, and low fidelity requirements. STOW TDBs produced by TEC's Operations Division are available for reuse.

- ***Military Operations in Built-up Areas (MOBA) TDB and Evaluation Project.*** The MOBA TDB is a high fidelity TDB of the Ft. Benning McKenna Military Operations in Urban Terrain (MOUT) site. TEC produced this database for the Dismounted Battlespace Battle Lab (DBBL) to support dismounted infantry simulations and Warfighter evaluations. The final TDB is formatted for ModSAF, Loral's Vistaworks, and Silicon Graphics' Performer applications. The information obtained from the evaluation of these TDBs and associated data products will be instrumental in assessing whether these Build 1, very high resolution M&S TDBs satisfactorily meet the Warfighter's dismounted infantry level simulation requirements for urban terrain.

- ***Rapid Construction of Virtual Worlds (RCVW).*** The RCVW program, funded by DMSO, is focused on continued research in computer assisted and automated processes in the building of M&S TDBs through transformation of standard NIMA digital topographic data (DTD) elevation, feature, and controlled imagery products. The goals of the RCVW effort include rapid terrain data (elevation and feature) generation from imagery products; very high resolution modeling of terrain, structures, and vegetation; and TDB verification.

- ***Synthetic Environments Data Representation and Interchange Specification (SEDRIS).*** The goal of SEDRIS is to provide a means for exchanging terrain data among heterogeneous models, simulations, and simulators rapidly, effectively, and with minimum data loss. In the absence of a robust interchange mechanism, STRICOM, DARPA, DMSO, and NIMA-TMPO have initiated this effort to develop a consensus based standard interchange mechanism.

- ***Rapid Terrain Visualization Advanced Concept Technology Demonstration (RTV***

ACTD). The objective of the RTV ACTD is to demonstrate capabilities to rapidly collect source data, generate high resolution digital terrain elevation data and feature data, and transform these data sets into databases for legacy and objective systems that support terrain evaluation, analysis and visualization. At the direction of the Deputy Assistant Secretary of the Army for Research and Technology (DASA-R&T), the Joint Precision Strike Demonstration Project Office (JPSD-PO) was asked to develop a concept for the RTV ACTD in June 1995. The concept developed was subsequently approved as a 4 year program beginning in FY97.

- ***Model and Simulation Resource Repository (MSRR) Master Environmental Library (MEL).*** MEL is a sponsored distributed environmental data access system which allows users to search for, browse, and retrieve environmental data from distributed sources.

PRIORITIES FOR NEXT YEAR

Five Terrain category proposals were submitted in response to the FY99 call for AMIP proposals. The titles of the projects and submitting organizations include:

- ***Automated Digital Elevation/Feature Height Data (TEC)***: The objective of this proposal is to research a method that allows collection of "bare earth" elevation data. Current collection methods capture elevation values from the top of the vegetation cover.
- ***Modular Terrain for Entity Level Computer Generated Forces (TRAC MTRY)***: To create a prototype standard modular terrain API for entity level simulations (CGF,SAF, etc.).
- ***Automated Database Verification and Validation (V&V) (STRICOM)***: Develop automated VV&A tools for building and modifying tactical databases.
- ***Determination of Terrain Fidelity in Army Simulations (TEC)***: To assess the "terrain realism" of Army simulations.
- ***Detailed Terrain Modeling Process Improvement Program (DTMPIP) (MRDEC)***: To develop a process, whereby detailed terrain models can be built using NIMA and USGS data for a Virtual Prototype Simulator.

Each of the projects submitted was evaluated and rank ordered by the Terrain Working Group participants attending the AMSO sponsored Army M&S Standards Workshop held at Carlisle Barracks from 4-7 May 1998. The top proposal, *Automated Digital Elevation/Feature Height Data,* was nominated for Army Model and Simulation Management Program Working Group (AMSMP WG) FY99 funding consideration. The number one proposal will be briefed to the AMSMP WG in Aug 98 and recommended for funding.

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VERIFICATION, VALIDATION, AND ACCREDITATION

STANDARDS CATEGORY DEFINITION

Verification is the process of determining if the M&S accurately represents the developer's conceptual description and specifications and meets the needs stated in the requirements document.

Validation is the process of determining the extent to which the M&S adequately represents the real world from the prospective of its intended use. This process ranges from single modules to the entire system.

Accreditation is an official determination that the M&S are acceptable for its intended purpose.

STANDARDS REQUIREMENTS

1. Establish and define standard verification, validation and accreditation processes.
2. Build verification and validation tools and guidelines
3. Develop measures of effectiveness to identify key elements and establish validation tolerances.

ACCOMPLISHMENTS AND ASSESSMENTS

DoD Verification, Validation & Accreditation Technical Working Group (VV&A WG)

The VV&A TWG spent the first half of the FY98 completing review of the guidance documents (e.g., DoD 5000.61, 5000.59, VV&A RPG) by providing a forum for lessons learned and AARs. Based on information gleaned, the TWG established the Technical Support Team (TST) to resolve inconsistencies in guidance documents and revise the RPG. In addition, a panel (floating membership derived from TWG volunteers) was established to provide guidance and commentary on ongoing VV&A plans and activities. The first major effort involved the Joint Theater Missile Defense Planner (JTMDP) Verification, Validation & Accreditation (VV&A) Plan. Additional use cases are being sought.

VVA TWG Technical Support Team (TST)

The TST was formed in March 1998 to identify inconsistencies in DoD and Service VV&A policies and documents, develop DoD-level VV&A curriculum, and revise the DoD VV&A Recommended Practices Guide (RPG). Current tasks include:

Revising the RPG:

Examine RPG presentation and publication alternatives.

A major criticism of the current RPG is that it does not provide enough information and the information provided is not organized for easy application by the user. Another weakness is that the current RPG is not "numbered." The TST is reviewing "official" document standard to determine which is most appropriate for the type of guidance intended. The goal is to evolve the RPG into a "numbered" DoD document that can be easily used by a broad spectrum of users. The TST is also exploring the possibility of developing the RPG as an on-line, multi-layered document, allowing the reader to "click" and follow various paths depending on his or her immediate needs.

Develop appropriate diagram for the Revised M&S Life Cycle Process model.

Based on the results of the Verification, Validation and Certification Tiger Team and a review of the RPG, work is being done to update and improve the graphic depiction the M&S Life Cycle Process model.

Prepare white papers on V&V issues as potential RPG topics.

During the M&S community review of the RPG, a number of VV&A issues and topics were recommended for inclusion in its revision: leveraging, requirements definition, risk management, costing, role of data, roles & responsibilities, requirements tracing, documentation, conceptual model validation, results validation, subject matter experts, distributed simulations, interoperability, human in the loop, auditing – problems to avoid, quality assessment (QA) vs. validation, contracting, V&V vs. testing/T&E/IV&V, training, functional areas, existing vs. new, ethics, automated tools, integrated product teams, statistical techniques, tailoring, independence, configuration management, accreditation, resolution & fidelity, acceptability criteria, measures of merit, design & software verification, live. The TST is preparing white papers on a number of these topics.

Identifying inconsistencies in DoD and Service policies and procedures.

Review DoD and Service M&S policies and procedures. The TST is reviewing all official V&V policy and procedural documents to identify inconsistencies. Inconsistencies and recommendations are reported to the TWG.

Examine VV&A and VV&C terminology.

Although the TST will use official definitions as provided in the DoD M&S Glossary and Service regulations, it is collecting term and definition issues to be used during an upcoming DoD M&S Glossary review.

Educating the public.

Establish a DoD M&S V&V web site to include V&V bibliography, V&V topic papers, models, etc.

Develop a DoD-level VV&A curriculum. Currently there are no opportunities for V&V agents and M&S developers, managers and users to acquire adequate VV&A training. The TST is identifying the types of information needed to conduct a DoD-level VV&A effort to incorporate into a curriculum recommendation.

The VV&C Tiger Team was formed in response to M&S community requests for information on data VV&C. It was established by the TWG to identify issues pertaining to current data VV&C processes, guidelines and practices and to provide actionable recommendations. Team members consisted of data and VV&C experts throughout the DoD M&S community. Three subgroups were formed.

> One pulled together information on VV&C and established an on-line reference library (to be available soon from the DMSO website).
>
> Another surveyed the M&S community and identified data quality information needed by data users that should be provided by data producers or data documentation. This information was prioritized and organized into a template.
>
> The third subgroup reviewed previous work done on data VV&C (DMSO sponsored effort to develop a generic VV&C process model) and concluded that is was appropriate and reasonable to separate producer data VV&C responsibilities (i.e., data quality assessment) from those of the data user. A generic data user VV&C process model was decomposed (i.e., activities and relationships were defined) and integrated with the DoD M&S Life Cycle Process model (DoD VV&A RPG) using IDEF0. The model subgroup completed their task by providing definitions for all activities, inputs, outputs, controls, and mechanisms.

Once consensus of the entire tiger team was reached on each subgroup's results, a white paper was prepared and presented to the VV&A TWG who accepted the results and recommendations and presented them to the MSWG. Major findings and recommendations include:

Producer V&V responsibilities are separate from User V&V responsibilities. Recommend data producer V&V responsibilities be designated "data quality assessment" and be considered separately from user VV&C.

Certification, particularly by data users, is primarily an implicit function and a natural part of any M&S accreditation process and does not need to be separately or explicitly identified. Recommend de-emphasizing the collective term VV&C and referring to user V&V.

User V&V activities integrate with VV&A activities. Recommend that user V&V be fully integrated into the VV&A process such that the VV&A TWG included user V&V in its mission to include developing policies, standards and procedures and identifying tools and techniques and examine its membership to ensure fair and equitable representation.

Simulation Interoperability Workshop (SIW). The VV&A Forum focused efforts in two areas this year:

Working with the PROC Forum to develop an appropriate FEDEP (federation development process) model. Once the FEDEP model has sufficient detail, the VV&A, Test, and Analysis Forums will develop overlays of their respective processes.

Together with the Analysis, RDE, and T&E Forums, sponsoring the Fidelity Implementation Study Group (ISG) which is chartered to develop a

- lexicon for simulation fidelity terms and concepts;
- contextual framework relating them to simulation theory; and
- set of methods and metrics by which fidelity is defined, estimated and measured.

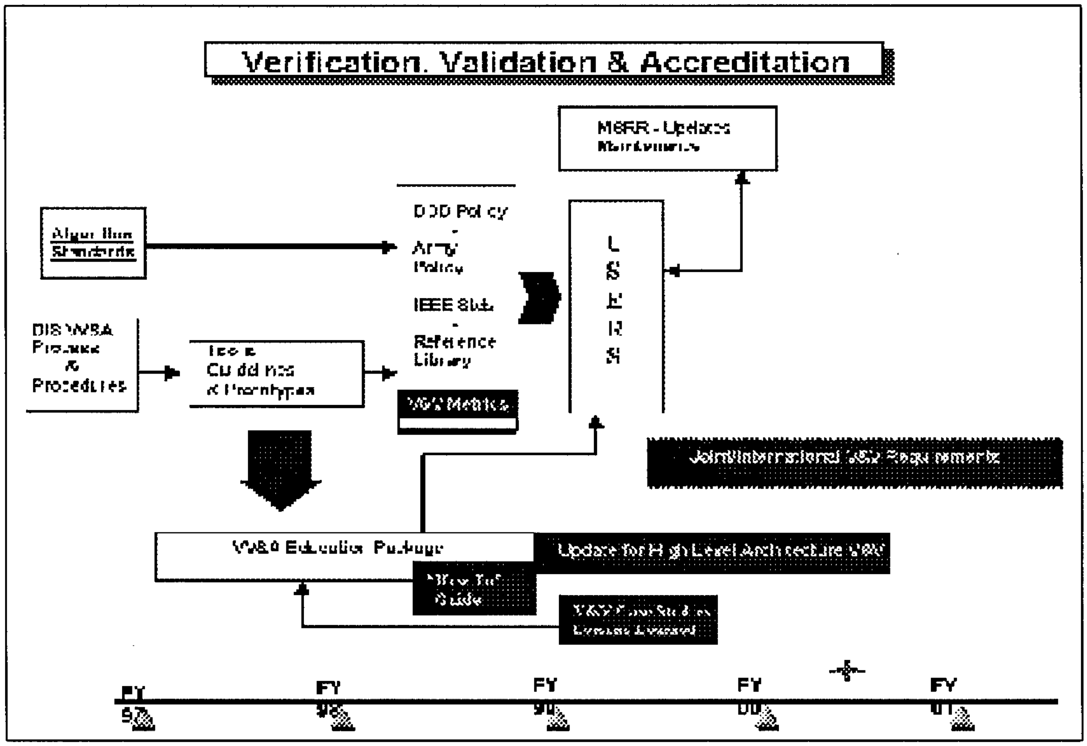
The Fidelity ISG is hosting a special Fidelity session at the Fall 98 Workshop and is expected to present its results at the Spring 99 Workshop.

PRIORITIES FOR NEXT YEAR

The priorities for this category will be the continued education of users and developers in the methodologies, processes and procedures for VV&A. This will be accomplished through documentation, presentations, and tutorials. Another high priority is the development of a V&V Manager's Toolkit. It will support the planning and execution of all types of Verification and Validation programs ranging from IV&V to VV&A of unitary models and simulations (M&S) to HLA-based large-scale distributed simulations suitable for war games

and National exercises. The V&V Manager's Toolkit will provide an automated process that provides realistic costing, tailoring, scheduling, risk management, and practical metrics.

ROADMAP



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APPENDIX E

AMIP Proposals Approved to Receive FY99 Funding (sorted by Project Title)

AMIP Proposals Approved to Receive FY99 Funding
(sorted by Standard Category)

SCC	Project Title	Page
Acquire	Acoustic Modeling for Army Studies	163
Acquire	Radar and Contrast Model Identification and Standard Development	217
Attrition	Compendium of Aggregate Level Attrition Algorithms	185
C4I Integration	C4I Interface Data Exchange Format Development	171
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Data	Characteristics and Performance (C&P) Data Interchange Format (DIF) Development	175
Deployment/ Redeployment	Development of an Extensible Hierarchy and Object Representation for Transportation Models and Simulations	197
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Dynamic Atmospheric Environments	3D Static Environments and Initialization	159
Dynamic Atmospheric Environments	Light Scattering for Wargames and Target Acquisition (LSWTA)	209
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Move	Development of Aggregation Standards for On-Road/Off-Road Logistical movement in Theater-Level Warfare Simulation	193
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Object Management	Army Object Standards Development	167

PROJECT TITLE 3D Static Environments and Initialization

STANDARD CATEGORY Dynamic Atmospheric Environments

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EXECUTIVE SUMMARY

The operational Army operates in a 4D environment. This places upon the modeling community a need to provide simulations in a spatially realistic 3D environment. Typically the source of environmental data such as temperature, wind speed and direction, humidity and level of turbulence is a database, which generally contain values at a point or perhaps along a line. Such information is not adequate to realistically portray the environment, its variability or its effects. The proposed effort will improve and combine existing techniques/models to produce a complete static 3D description of the environment based on input from typical data sources.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds			**$75**	**$75**
Other Source(s) of Funding*	**$500 (ARL)**		**$25**	**$25**
Total			**$100**	**$100**

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

Many models (e.g. weapon effects, chemical hazards, smoke and obscurant) used in simulations are effected by the atmosphere and its spatial variability. To realistically portray the effects of the atmosphere, dynamically correct, 3D environmental data which include variations imposed by terrain and terrain based objects must be readily available. Typically the source of information is a database containing values at a single point or along a line. Environmental parameters are highly spatially variables and are influenced by the terrain (e.g.

winds) such that the error induced by imposing a uniform field or standard linear interpolation may effect the outcome of the simulation. The proposed effort will provide for physically realistic, spatially varying values of temperature, pressure, humidity and wind in a 3D grid.

TECHNICAL APPROACH

The High Resolution Winds (HRW) model developed by the US Army currently provides a two-dimensional field of wind (speed and direction) based on a unique application of the mass consistency concept. This approach results in a validated model which provides a more representative effect of terrain variability on 2D wind flow than traditional mass consistent models. This project will modify this HRW model to allow the effects of buildings, tree and cropland canopies on the air flow resulting in a horizontal wind field which is more representative in areas that consist of features other than bare ground. In order to include the effects of buoyancy the current version of HRW utilizes temperature information. Therefore, the flux of heat and moisture are additional calculable quantities that will be provided or used to determine other important meteorological parameters such as the level of turbulence and atmospheric stability. Finally the model will be extended or merged with another mass consistent scheme (such as DSWA's SWIFT model or LLNL's MATHEW model) to achieve complete 3D variable fields that have improved coupling to surface layer effects.

PRODUCTS

The major deliverable of this proposal will be a software package that will be able to provide a realistic 3D field of such environmental parameters as wind speed and direction, temperature, humidity. The package will be made available in both source code as well as compiled code and can be easily integrated into existing M&S efforts such as the Master Environmental Library and the TAOS weather server. Documentation will be included with the package to enable the user community to better operate the software.

MILESTONES

Step 1 Accurate yet smooth representation of terrain data	- 3 Mths after start
Step 2 Integration of high resolution low level winds	- 3 Mths after step1
Step 3 Subset extractor	- 3 Mths after step 2

RISK/BENEFIT ANALYSIS

The incorporation of the proposed improvements will lead to more accurate representation of meteorological fields within Army's modeling and simulation community. With these improvements one can more accurately model or simulate the release of biological or chemical agents, the temporal transport of an obscurant field, or any other aspect of simulation that is dependent upon highly realistic and accurate meteorological fields.

EXECUTABILITY

The basic structure for performing this proposal is already in place. There is already in existence a code-base from which we can begin to build this project. The greatest technical obstacle is the incorporation of the high resolution low level winds model. However, this should not be to hard to overcome due to previous experience with incorporation of various software products.

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PROJECT TITLE Acoustic Modeling for Army Studies

STANDARDS CATEGORY Acquire

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EXECUTIVE SUMMARY

Many new combat systems include an integrated suite of sensors covering different portions of the spectrum. Army force-on-force models have focused on visual, mid-infrared (IR), far-IR and some radar performance; however, acoustic sensors have been largely ignored. With the onset of systems such as the Wide Area Mine (WAM), Remote Sentry System, Integrated Acoustic Sensor, and the Future Scout and Cavalry System (FSCS), the Army analytical community can no longer afford to ignore this aspect of target acquisition. We simply must be able to demonstrate the benefits of acoustic sensors, for both enemy and friendly forces, and be able to quantify them. The selected model (or set of algorithms) will be proposed as a standard in the standard category Acquire.

FUNDING PROFILE:

$K	Prior Funding & Source	FY99 OMA	FY00 OMA	Project Total
AMIP Funds		$75K	$30K	$105K
AMSAA mission		$40K	$25K	$65K
TRAC-WSMR mission			$50K	$50K
Total		$115	$105K	$220K

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

Integration of multiple sensors, covering different portions of the spectrum, should provide a synergistic effect in the target acquisition process. Two key elements missing from the Army's force-on-force target acquisition modeling capability are acoustic sensors and information fusion. While the information fusion process is not yet mature enough to warrant

a concerted effort at this level of fidelity, several systems using acoustic sensors are currently in development and will require analysis in the next few years. Among the systems in development are the Integrated Acoustic Sensor and the Remote Sentry System. In addition, the WAM has an acoustic capability. Similarly, requirements for the FSCS address acoustic array sensor performance and FSCS susceptibility to aural detection. Of course, all systems with soldier operators include aural sensors.

The Army analytical community recognizes the need for an acoustic sensor modeling capability (for representing both enemy and friendly forces), and several have been identified that may be candidates for inclusion in force-on-force models such as CASTFOREM, Groundwars and Janus. The Rand Corporation has already developed an acoustic modeling capability for Janus under the auspices of the Deputy Secretary of the Army for Research, Development and Acquisition / Deputy Assistant Secretary for Research and Technology. Unfortunately, the algorithms are integrated in the Graphical Information System, not directly in the Janus code. Therefore, it may be difficult to extract them. In addition, ARL has been involved in developing algorithms that may be adaptable. Models such as the Acoustic Detection Model, Battlefield Acoustic Sensor Integration System, ICHIN (I Can Hear It Now) and the Battlefield Acoustic Sensor Evaluator provide additional alternatives.

The planned analysis will be a two year effort with the first year being devoted to determining what algorithms should be adopted as standards, and the second year being the actual incorporation of the standard algorithms into the Army force-on-force models.

TECHNICAL APPROACH

This approach is inherently feasible, since no new algorithms will be developed in this project. Existing algorithms will be examined and adapted to fill the need. Criteria for selection of algorithms will include: i) accuracy of predictions [probability of detection, recognition, ranges], ii) ease in inserting algorithms in the force-on-force models, iii) availability of supporting data, and iv) ease of use. To the extent possible, verification and validation of the algorithms – in a stand-alone mode – will be accomplished.

PRODUCTS

A standard in the Acquire category.

MILESTONES

Q1:	List of models/algorithms under consideration. Establish selection criteria.
Q2-Q3:	Quantification of algorithm performance. Compare of results with empirical data.
Q4:	Final model/algorithms selected.

	Final discussions with TRAC, ARL, et al.
	Standard algorithms and documentation delivered.
Q5-Q8:	Algorithms incorporated into force-on-force model.
	Input data developed/obtained.
	Verification/Validation of model performed.
Q7-Q8	Comparison of Algorithms to Standard Sensor Object
	And coordination with SC Object Management and SC Data

RISK/BENEFIT ANALYSIS

The risk of this approach is extremely low, as no new algorithm development is required. The only discernable risk is that of obtaining data against which to compare model results. At least one such source is currently resident at AMSAA. The primary benefit is to enable the inclusion of explicit modeling of a relatively new technology (acoustic sensors) in Army analyses.

EXECUTABILITY

In-house:	95%
Contract:	0%
Travel:	5%

During FY99, virtually all of the work on this task will be performed in-house in AMSAA. Some consultation with ARL, Rand Corporation and the Pennsylvania State University will be required, but it will be done on an ad hoc basis – travel from APG to remote sites will be required, but no additional funding will be required. During the second year, AMSAA and TRAC-WSMR will work jointly to incorporate the algorithms in the Army force-on-force models.

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PROJECT TITLE Army Object Standards Development

STANDARD CATEGORY Object Management

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EXECUTIVE SUMMARY

Object Management Standard Category (OMSC) members will design, test, and document objects for use as standards in Army model and simulation. Activities to be conducted are

- Object development:
  - Environment Objects (Terrain, Atmosphere, Space, and Ocean Objects)
  - Simulation Services Objects
  - Logistics Support Services Objects
  - Behavior Framework/Object Integration

- Linkage of Platform and Unit Objects to standard algorithms
- Test use of Platform, Unit, and Environmental Objects in Object-Oriented (OO) Simulation Environment
- Update of OMSC website to allow easy navigation of objects, object methods, object definitions, and access to standard algorithm sources

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	120	125		245
Other Source(s) of Funding*	75 (AMSAA) 45 (AMSO)	50 (AMSAA)		125 45
Total	240	175		415

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

Object-oriented programming offers the potential for increased code reuse, maintainability, and ease of developing new simulations. Because of these benefits, the use of object-oriented technologies will increase over time. To prevent duplication of effort and the development of incompatible models, the Deputy Undersecretary of the Army for Operations Research directed the development of standard Army objects. This proposal encompasses the tasks necessary to develop new objects as well as conduct the testing, documentation, and coordination of standard objects to insure that they contain the minimum essential elements necessary for widespread application.

TECHNICAL APPROACH

Based on the component-based OMSC design philosophy, this effort will develop functional definitions of objects that are robust and reusable by different simulation applications. The approach resembles the model-test-model methodology used by the M&S community. Specifically, this project will first develop a set of objects, object methods, and object metadata proposed for M&S community use (see following list). These objects will undergo testing through application in an object-oriented simulation environment (e.g., G2). The draft object will then be coordinated with representatives of the M&S community to obtain consensus (i.e., the AMSO Policy and Technology Working Group and the Army M&S Standards Categories). Finally, the draft objects will be documented via a technical report and submitted to SNAP for approval and entry into ASTARS. Additionally, objects developed by other activities will be reviewed as potential object standards. The following will be addressed in this AMIP proposal:

- New object development:
    - <u>Environment Object</u>: comprised of Terrain, Atmos, Space, and Ocean Object;
    - <u>Simulation Services Objects</u>: represents functions such as the Simulation Engine, Simulation Management, Event Mangers, etc.;
    - <u>Logistics Support Services Objects</u>: represents assembly points, maintenance facilities, etc.
    - <u>Behavior Framework/Object Integration</u>: classification and integration of the manner in which behavior, from individual soldiers up to command level, is integrated in Army standard objects (i.e., elemental instruction sets, combat instruction sets, and command decision modeling sets)

- Linkage of Platform and Unit Object methods to standard algorithms: this will provide documentation on the standard algorithms and algorithm sources necessary to execute the Platform and Unit object methods. If standard algorithms cannot be found, a SNAP Standard Requirement Document will be submitted.

- Sample execution of the Platform and Unit Object in an OO simulation environment: this exercise will select and build a sample OO simulation using the standard objects to ensure that the minimal essential set of object elements are defined.

- Updated website that will list objects, object methods, object definition, and standard algorithm references.

PRODUCTS

The following reports will include a description of the object, object metadata, and object definitions. Also included will be the results of the test application of the object to existing or developmental simulations:

- Environment Objects Report
- Simulation Services Objects Report
- Logistics Services Support Objects Report
- Behavior Framework/Object Integration Report
- Platform Object Standard Algorithm Reference Report
- Unit Object Standard Algorithm Reference Report
- Updated website to provide documentation and references to object instantiation

MILESTONES

	O	N	D	J	F	M	A	M	J	J	A	S
Environ Objects	←	—	—	—	—	—	—	—	→			
Simulation Services Objects	←	—	—	—	—	—	—	—	→			
Logistic Support Services Object			←	—	—	—	—	—	→			
Behavior Frame	←	—	—	—	—	—	—	—	→			
Platform/Unit Object Testing			←	—	—	—	—	→				
Update Website									←	—	—	→

RISK/BENEFIT ANALYSIS

The projected cost for this project is $125,000. The risk to complete this effort is low. Initial solutions to the problems addressed by this project have been discussed within the OMSC. The major challenge is to develop a set of solutions tailored to the needs of the Army M&S community and have widespread applicability. The ultimate benefits to be derived from the availability of standard Army objects include:

- reduced knowledge engineering development efforts for new models
- enhanced interoperability/interactivity
- reduction in duplication of effort, and
- identification of investment opportunities to address modeling and simulation voids.

EXECUTABILITY

The funding requested for this project will be used for in house government labor at AMSAA, NSC, STRICOM, TRAC-WSMR, TRAC-FLVN, TRAC-MTRY, and CAA.

PROJECT TITLE C4I Interface Data Interchange Format Development

STANDARD CATEGORY C4I Integration

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EXECUTIVE SUMMARY

AMIP-98-VIS, Architecture Alignment identified operational, systems, and technical integration requirements between Modeling and Simulation (M&S) and Command, Control, Communications, Computers and Intelligence (C4I). The Visualization Team proposed a C4I Interface Model that specified types of data exchanged between M&S and C4I. The purpose of the C4I Interface Model is to "divide and conquer" standards between M&S and C4I by categorizing data as Exercise Control, Persistent, and Non-Persistent. This project will develop data interchange formats (DIFs) that instantiate the C4I Interface Model through standards. The standards would bridge HLA with DIICOE while allowing independent development of M&S and C4I.

FUNDING PROFILE

$K	Prior Funding & Source	FY99 OMA	FY99 OPA	Project Total
AMIP FUNDS	N/A	$50K	N/A	$50K
Other Funding Sources	DISC4	If Available	N/A	TBD
Total				$50K

BACKGROUND/DESCRIPTION OF THE PROBLEM

C4I Interface Standards are needed for Advanced Concepts and Research (ACR), Research, Development and Acquisition (RDA), and Training, Exercises, and Military Operations (TEMO) as well as Simulation Based Acquisition (SBA). For ACR, Advanced Warfighting Experiments above brigade level use the synthetic environment to stimulate (SIM/STIM? C4I for analysis of the digitized battlefield. For RDA, the synthetic environment stimulates C4I systems before fielding to insure they are built to accelerate situational awareness and sensor

to shooter enabling information dominance. For TEMO, warfighter skills are developed and maintained on C4I stimulated by the synthetic training environment. During military operations, the synthetic environment displays courses of action on C4I, and permits end to end "burn-in" and rehearsals using the C4I infrastructure. SBA must integrate all the domains from conception of C4I through development and testing to fielding and sustainment of digitized battlefield skills. SBA will rely upon the C4I DIF Standards to achieve this integration. Current architectures supporting SIM/STIM are custom, point to point, and overhead intensive. Standard DIFs for C4I are needed to promote reuse, composability, and extensibility. M&S and C4I using DIFs would reduce "black boxes" and operators in the sim/stim architecture, and enable plug and play of Army Battle Command Systems (ABCS) into live, virtual, and constructive simulations.

TECHNICAL APPROACH

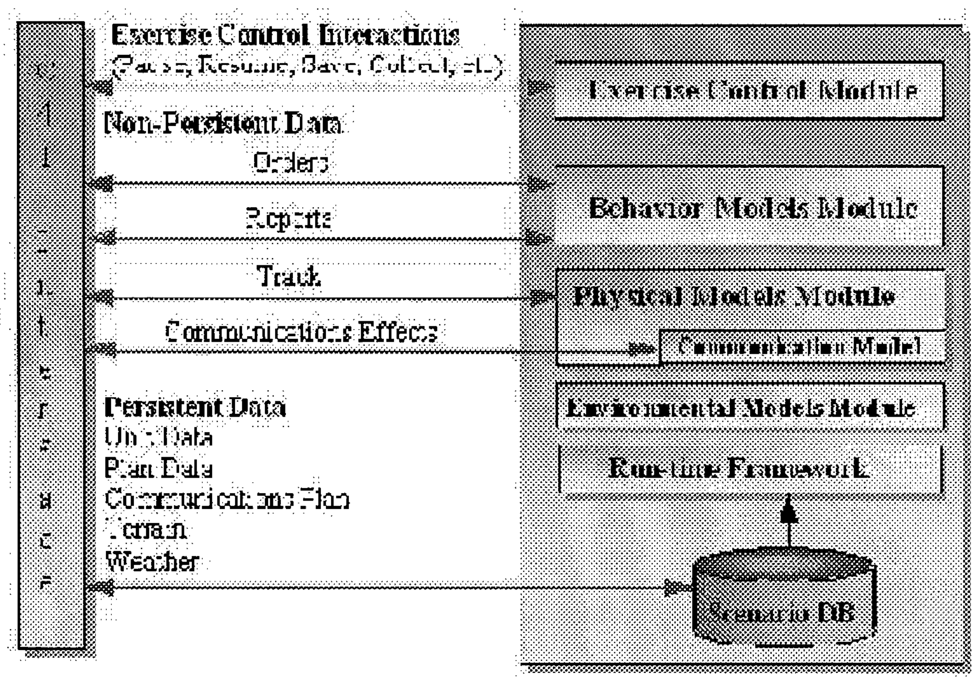

Figure 1. – C4I Interface Reference Model

1). Using the C4I Interface Model (Figure 1), develop and gain consensus on Classes of DIFs for Exercise Control, Persistent, and Non-Persistent Data. Develop consensus among Army & DOD M&S and C4I Communities including DISC4, TPIO-ABCS, AMSO, PEOC3S, STRICOM, CECOM, TRAC, DMSO and DISA.

2). Write and present papers for the 1999 Spring and Fall Software Interoperability Workshops (SIW) to document the C4I Interface Framework developed in 1). Present paper to the Fall Military Operations Research Society (MORS) Symposium and relevant DII COE Technical Working Groups (TWGs).

3). Coordinate development of the DIFs identified in 1). Utilize existing standards where appropriate, and coordinate with other SCCs when standards fall in their responsibilities (i.e. Terrain & SCM).

4). Investigate the development of Technical Reference Federation Object Models corresponding to the DIFs in 1).

PRODUCTS

a. Data Interchange Formats in each of the three major areas identified in the C4I Interface Model.

b. Conference Papers documenting the Framework and Technical Model for Army C4I Interfaces

MILESTONES

Event	Date	ASTARS Input
Fall MORS Symposium Paper Presentation	OCT 98	
Exercise Control DIF		NOV 98
Non-Persistent Data DIF		JAN 99
Spring SIW Paper Presentation	MAR 99	
Persistent Data DIF		MAR 99
Fall SIW Paper Presentation	SEP 99	

RISK/BENEFIT ANALYSIS

Current interfaces linking M&S with C4I are costly, overhead intensive, require extensive integration testing for SIM/STIM events, and nearly impossible to sustain end-to-end configuration management. SIM/STIM shortfalls resulted from custom point to point linkages that were reverse engineered into legacy systems not intended to interoperate. Currently, there is not a consensus on how to interface between the M&S (HLA) and the C4I (DII COE) domains in the Joint Technical Architecture-Army. Until this consensus is

developed, the Army will not develop composable and extensible interfaces. The Army DII COE community is requesting M&S input. Establishing DIFs now, giving guidance to Army C4I & M&S developers, averts costly re-engineering or reverse engineering in the future.

EXECUTABILITY

This project utilizes existing Army contracts for developing concepts and engineering DIFs. Technical expertise from AB Technolgies, Inc., leaders in M&S and C4I technologies, will develop papers that build consensus for C4I Interface Standards and document DIFs for these Interface Standards. These efforts will establish the initial concept for C4I Interface Reference FOMs.

PROJECT TITLE	Characteristics and Performance (C&P) Data Interchange Format (DIF) Development
STANDARDS CATEGORY	Data
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EXECUTIVE SUMMARY

In an effort to provide a framework for the development and automation of databases and standardization of data infrastructures, a data interchange format (DIF) for characteristics and performance (C&P) data is required. In FY98, AMSAA and NGIC began development of standard data models and mapping functions that will form the basis for constructing the DIF. This year's effort will extend those models and mapping functions to include TRAC and CAA C&P data. This will be accomplished by reviewing existing data models from TRAC and CAA. Where necessary, the databases will be reverse engineered and a data model will be developed. The common data model will become the standard and a data standardization proposal package will be submitted to the DoD Data Dictionary Administrator.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	100	90	0	190
AMSAA	60	60	0	120

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
NGIC	40	40	0	80
CAA	0	25	0	25
TRAC	10	40	0	50
Total	210	255	0	465

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. In order to appreciate the value of data interchange formats and their application to the establishments of data standards, a brief discussion of database management considerations is essential.

2. Until quite recently, databases supporting computer programs were simply collections of data values made available through various media, then accessed and applied only by the using software. This management approach necessitated laborious preparation and maintenance of data values, with little or no advantage from automation. The predictable outcomes were high costs, numerous errors, and adverse impact on the results obtained through computer applications in general.

3. In effect, the data had no life outside the using program. Therefore, application programs were required to perform data quality functions in their programs right along with the essential functions of the program. This process occurs each time the program is run and results in excessive duplication of effort and different interpretations of how to correct the data.

4. Widespread realization of the inefficiency of this situation resulted in the advent of general-purpose database management systems. These systems afforded the full leverage of computer automation to the task of preparing and maintaining data for multiple software application programs. They established common (standard) representations and enforced pertinent rules regarding allowable values and agreed-upon relationships among the values. At last the data could remain alive outside of the using programs.

5. Even greater reliability, efficiency and portability of database designs and implementations were realized with the introduction of technically rigorous, standardized data modeling.

6. Data interchange formats rely on data models to develop data standards that can be used to effectively and efficiently transfer data between data producers and data consumers. They provide a standard view of the area of interest through a data model of the subject area of interest (SAI) and the use of common semantics and syntax to facilitate

communication and understanding. A mapping function that translates from the consumer's lexicon to the standard lexicon and from the standard lexicon to the producer's lexicon is also incorporated. Through this process the consumer can request data from a producer in the consumer's native language. The figure below shows the value of data standards and the DIF. With five databases and no standards, 20 transformations are required. With standards, only ten are needed. This advantage grows rapidly as more data sources are considered. This concept also allows existing databases to continue to function without alteration and provides a standardized construct for designing new databases.

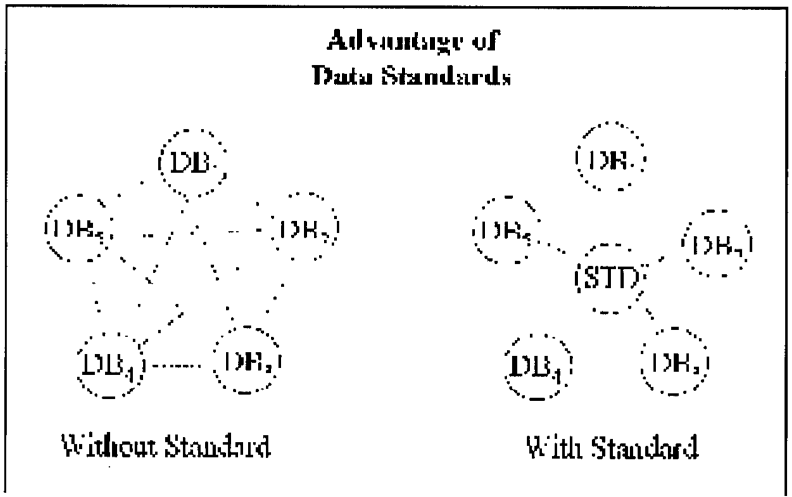

Figure 1. Advantage of sharing data through a standard

TECHNICAL APPROACH

The C&P area is very broad and complex. The first step of the task will be identifying TRAC-FLVN and CAA data areas that intersect the current common data model (built during the FY98 part of this project). Next subject matter experts (SMEs) within that scope will be identified. A series of meetings will be held between the SMEs, repository administrators and the data modelers to gather the information needed to integrate TRAC and CAA data elements into the SAI model. Mapping functions from the common model to TRAC and CAA (and vice versa) will also be developed. This integrating and mapping step is critical since the SAI model is the centerpiece of the standardization effort and the mapping function acts as a translator between the consumer and producer. The software development, testing and deployment tasks associated with the C&P effort will be initiated as time and funding permit.

PRODUCTS

The products from this effort are:

1. Lists of data sets and sources to be addressed
2. Standard subject area of interest models
3. Mapping functions
4. Final report describing accomplishments and follow-on efforts
5. Data standardization proposal packages

MILESTONES

Source Lists	December 1998
Revised SAI Models	March 1999
Expanded Mapping Functions	May 1999
DOD Data Dictionary Submission	August 1999
Final Report	September 1998

RISK/BENEFIT ANALYSIS

1. The technical risks associated with developing the C&P DIF are rooted in the inherent complexity of modeling complex performance data. The process of creating a DIF and the tools for doing so have been tested and fine-tuned during the generation of other DIFS by DMSO. AMSAA and NGIC's effort in FY98 also provide lessons learned and constant communication with TRAC and CAA over the past year make them familiar with the task. This experience base lowers the risk associated with this project.

2. The benefits of this project are standardization and re-use of C&P data among Army and Joint M&S organizations. These standards can be applied to new data systems to make a seamless network of composable solutions.

EXECUTABILITY

The Army (TRAC, NGIC, AMSAA and CAA) will perform the work with support from DMSO.

Updated and expanded the Operating and Support Management Information System (OSMIS), an automated database of normalized, actual materiel operating costs used for Army OPTEMPO budgeting and Operations and Support acquisition costing. This data is collected annually, analyzed, distributed and used Army-wide.

CEAC continued to promote Army cost and economic analysis standards by distributing the Department of the Army Cost Analysis Manual and the Department of the Army Economic Analysis Manual, by facilitating the training of Army cost analysts in the use of ACEIT, and by providing expert cost estimating guidance.

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AMIP-99-CDM-01

PROJECT TITLE	CDM Composable Behavior Representation
STANDARDS CATEGORY	Command Decision Modeling
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EXECUTIVE SUMMARY

This proposal will identify and capture within a class hierarchy a standard way to represent cognitive methods. Products of this effort will be a Behavioral Object Taxonomy for Corps to Company Level and associated Cognitive Modeling Framework. The benefit of the proposed research would be more flexible and rapid development of command and control simulation by taking advantage of the object-oriented model development paradigm. This effort will feed the development of behavioral object standards to used by simulations such as JSIMS, WARSIM 2000, and OneSAF. This project will be executed under an existing NSC support contract with CUBIC Applications, Inc. in the NSC Command Decision Modeling Laboratory.

FUNDING PROFILE

$K	Prior Funding	FY99 OMA	FY99OPA	Project Total
AMIP		$120	$110	$230

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

The primary objectives of this framework are to:

- Identify and capture within a class hierarchy the standard ways to represent the run-time data requirements of cognitive models.
- Identify and develop the mechanisms to create a standard execution environment for cognitive models representing the behavior of decision-making entities within a larger simulation application.

- Identity standard cognitive model composition mechanisms that support the creation of a standard command and control language.

The framework design proposed takes the view that problem solving tends to be goal oriented and that rarely does a problem have a simple, step-wise procedure that yields the desired solution. It is the absence of a single, clear procedure that gives problem solving its inherent difficulty and complexity.

In order to deal with this dilemma, we propose that the problem be decomposed into tasks, where a task represents some fundamental unit of activity. This is an effective way of managing the complexity of problem solving and the Army Operational Architecture provides the template for the development of these fundamental units.

This view of problem solving is coupled with the understanding that cognitive models have many and varied data requirements and that cognitive model building can be viewed as a composition activity, where fundamental units of modeled behavior (tasks) are linked together to form more complete models of human behavior and command and control models.

In addition, task models that are loosely coupled and highly configurable maximize reuse and support mixed fidelity modeling. Flexible, dynamic task model composition mechanisms support the ability to express a wide variety of command decision-making behaviors via a command and control language.

TECHNICAL APPROACH

The proposed approach consists of the following steps.

1. Analyze existing software implementations and models for possible reuse or incorporation into this project.
2. Collect the general Operational Architecture terms from corps to company level for Command Decision Modeling.
3. Establish a vocabulary from the architecture for representing command decision modeling behavior primitives.
4. Develop taxonomy for these primitives.
5. Research the appropriate implementation of this taxonomy.
6. Complete the Cognitive Modeling Framework

PRODUCTS

Behavioral Object Taxonomy for Corps to Co Level
Cognitive Modeling Framework

MILESTONES

Month

Milestone	1	2	3	4	5	6	7	8	9	10	11	12
Review of existing Simulation Implementations and Concepts	X											
Collection of General Scenarios Architectures	X	X										
Develop Vocabulary of Representational Primitives		X	X	X								
Behavioral Object Taxonomy for Corps to Co Level					X	X						
Develop Hierarchical Model for Behaviors						X	X	X				
Research Appropriate Implementation of Hierarchy								X	X			
Cognitive Modeling Framework										X	X	X
Finalize Reports												X

RISK/BENEFIT ANALYSIS

The benefit of the proposed research would be more flexible and rapid development of command and control simulation by taking advantage of the object-oriented model development paradigm. This effort will feed the development of behavioral object standards to used by simulations such as JSIMS, WARSIM 2000, and OneSAF.

EXECUTABILITY

This project will be executed under an existing NSC support contract with CUBIC Applications, Inc.

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PROJECT TITLE Compendium of Aggregate Level Attrition Algorithms

STANDARD CATEGORY Attrition

POINT OF CONTACT

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EXECUTIVE SUMMARY

In 1996 the Attrition Working Group published the "Compendium of High Resolution Attrition Algorithms" as AMSAA Special Publication No. 77. This proposal calls for publication of a companion document titled "Compendium of Aggregate Level Attrition Algorithms." AMSAA has already initiated development of this document, which will include the direct fire attrition methodology being implemented in the Joint Warfare System (JWARS). A first draft of this effort will be completed during FY98 using mission funding. Funding of an expansion of this draft is required so that TRAC-FLVN (the TRADOC Analysis Center element at Ft. Leavenworth, KS) and the Concepts Analysis Agency (CAA) may document their portions of the compendium. AMSAA will serve as overall project lead and coordinator. A draft of the entire compendium will be produced, and the initial review will be accomplished, by the end of FY99. Additional reviews and modifications will be completed in 1Q FY00, with the final document published during 2Q FY00. These algorithms will then be proposed as standards for use in developing future aggregate level simulations for distributed environments, and will provide direct input as nominations to SNAP and ASTARS.

FUNDING PROFILE

Project	Prior Funding	FY99 OMA	FY99 OPA	Total
AMIP	**0**	**$60K**	**0**	**$60K**
Other Sources	**0**	**0**	**0**	**0**
Total	**0**	**$60K**	**0**	**$60K**

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

In early 1994, the US Army TRAC began leading a multi-service, multi-agency project, funded in part by the Defense Modeling and Simulation Office (DMSO). The purpose was to establish VV&A processes, methodologies, and tools. If successful, the project would improve the success rate of distributed interactive simulation (DIS) exercises while providing guidance to and reducing the burden on those actually performing VV&A of distributed simulations. Of the nine tasks defined for the first year of the project, the second of these was to establish processes to VV&A algorithms used in the various simulations linked in a distributed system. Much work in defining standard attrition algorithms had already been accomplished by AMSAA and TRAC-WSMR (the TRAC element at White Sands Missile Range, NM). Therefore, AMSAA offered to head the Attrition Working Group. This group, in turn, decided to divide its task into establishing high resolution attrition algorithm standards and aggregate level attrition algorithm standards. The "Compendium of High Resolution Attrition Algorithms" was published as AMSAA Special Publication No. 77 in 1996. The purpose of this proposal is to publish a companion document to provide a collection of standard attrition algorithms for aggregate level combat modeling. These attrition algorithms will be proposed as standards for use in future aggregate level simulations for distributed environments, and will provide direct input as nominations to SNAP and ASTARS.

TECHNICAL APPROACH

AMSAA has already initiated development of the companion document to support attrition standards at the aggregate level. Work on this document has focused on direct fire attrition processes. A first draft of this direct fire portion of the Aggregate Level Compendium will be completed during FY98 using mission funding.

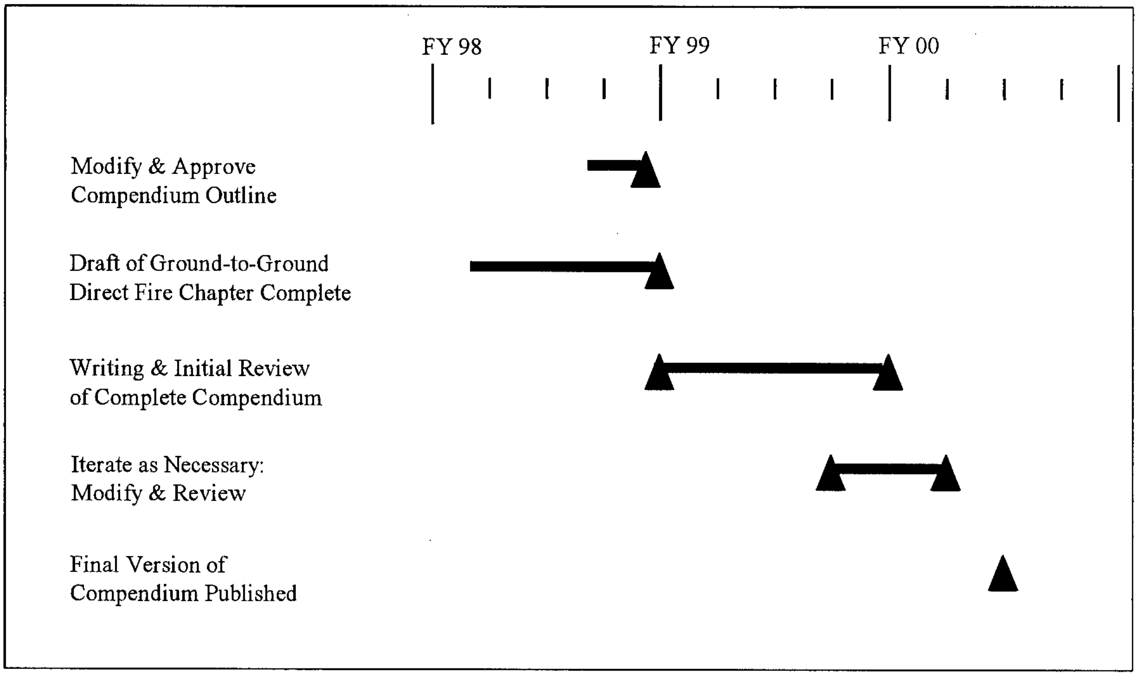
This proposal calls for expansion of the AMSAA effort in direct fire attrition to all forms of aggregate level attrition including ground-to-air, air-to-ground, air-to-air, indirect fire, and minefield attrition.

It is anticipated this will be a joint effort among AMSAA, TRAC-FLVN, and CAA. AMSAA will write the portions of the various chapters documenting algorithms used in the AMSAA Division Level (DIVLEV) wargame simulation along with much of the chapter on air-to-air attrition. AMSAA will also complete documenting the direct fire methodology being implemented in JWARS. AMSAA will serve as the overall project lead and coordinator. TRAC-FLVN will provide appropriate chapter portions for the Vector-In-Commander (VIC) and EAGLE division/corps level simulations, while CAA will provide similar information for the Combat Evaluation Model (CEM) and Force Evaluation Model (FORCEM) theater level simulations.

PRODUCTS

A complete draft of the entire compendium will be produced, and initial review will be accomplished, by the end of FY99. Additional reviews and modifications will be completed in 1Q FY00, with the final document published during 2Q FY00.

MILESTONES



RISK/BENEFIT ANALYSIS

There are three major benefits to be derived from establishing a collection of standard algorithms for representing attrition in aggregate level combat simulations:

Enforcing model consistency. If all aggregate level models linked in a distributed simulation treat attrition using the same algorithms and use the same performance data, then the probability of consistent weapon system performance from model to model is increased.

Supporting verification and validation. If the team performing V&V of a model or simulation to be linked into a distributed simulation system has a set of objective algorithm standards against which to compare algorithms implemented in the subject model, then results of their examination will depend less on subjective opinions of team members and more on the quality of the model.

Supporting model development. If developers of models and simulations to be used in distributed environments have a collection of algorithms that are known and accepted in the modeling community, then less effort need be wasted attempting to invent what has already been done, and the probability of producing an unacceptable model is reduced.

EXECUTABILITY

It is proposed that funding received for this project be allocated to organizations as follows:

AMSAA	20%
TRAC-FLVN	40%
CAA	40%

There will be no requirement for contractor support in order to complete this project.

PROJECT TITLE The Composable Behavior Standard Data Acquisition Project

STANDARD CATEGORY SAF

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EXECUTIVE SUMMARY

This is a joint project with TRAC and NSC which will set behavior composability standards for future Army simulations. It will consist of a data collection effort of the fundamental basic actions which are required to simulate human and system actions in Army, combat simulations, development of standard formats for use case presentation of behaviors, and development of a prototyping tool using the standard primitive library that can be used for rapid behavior generation in an object-oriented programming environment. The ability to utilize future simulation systems for realistic mission planning, mission rehearsal and analysis will rely on the ability to rapidly customize and modify behaviors consistent with the desires of the commander and, in essence, to make behaviors meet the skills, experience and tactical preferences of the major players. To accomplish this, standard behavior development approaches must be identified. Basic actions, sometimes called primitives, are ordered to logically simulate rational, human performance of simulated humans and systems. These primitive actions are identified and modeled implicitly or explicitly every time a simulation is built. This initiative will produce an English text library populated with primitive actions and their definitions to support future modeling at the high resolution, entity level; and a set of use cases which will take advantage of the developed primitive library to support behavior definition and identification for combat engineer functions. These use cases will be modeled in a simulation environment to verify the level of detail and applicability of the use case formats and to demonstrate the ease of verification and validation of the behaviors by Engineer subject matter experts (SME).

FUNDING PROFILE

	$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	130	0	130	0	130
Other Source(s)	0	65	0	0	65
Total	130	65	130	0	195

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. There exists Army documents which describe all the combat, combat support, and combat service support functions. There have been several attempts to synthesize these documents into software engineer friendly requirements to facilitate the instantiation of military art into computer simulations (i.e., CISs) and centralize all of these attempts into repositories (i.e., the Functional Description of the Battle Space). However, the simulations using these approaches to behavior instantiation are recognized as being extremely limited and inflexible. They provide a single level of fidelity that is inadequate to support the wide range of potential uses for simulations, ranging from mission rehearsal, course of action analysis, development of TTP's and other analyses. The M&S military user community requests a flexible system of behavior composability to prepare their simulations to handle the wide range of applications. To prepare a for composable behavior capabilities, standard elements and tools need to be identified.

2. One area identified that is used consistently in the development of Army simulations are basic, generic actions (referred to as "primitives") of simulated humans and systems. The invariable result of each new development is duplicate payment for the "discovery" and development of functionalities which are already established, known, but not reposed conveniently where they might be found and reused.

3. In addition, the only clearly documented methodology that is available for doing the knowledge acquisition for battlespace behaviors is the one that was used to identify the Combat Instruction Sets for the CCTT program. This methodology, however was not designed for an object-oriented environment and was extremely costly, in terms of both resources and time. The linear design and presentation of behaviors limits the value of the original document to the software design for future systems.

TECHNICAL APPROACH

1. Research for approach and/or identification of unique primitive requirements: from Army functional area simulations (i.e., Field Artillery, Armor, Transportation, etc.), existing models (i.e., CASTFOREM, ModSAF, etc), requirements for future simulations (i.e.,

OneSAF, Combat XXI), work accomplished in the area of high fidelity, entity level behavior modeling (i.e., Composable Behavior Technology), Doctrinal databases (i.e., (NGIC's CMMS, CISs).

2. Achieve validation of primitives and their descriptions by functional area experts.
3. Develop a standard format for the collection and presentation of data by SMEs in a format that can be used by the programmer to write code for that behavior.
4. A series of use cases will be developed to identify Engineer functions that must be represented in a full fidelity simulation.
5. Use cases will be modeled in G2 and SanScript programming environments to test the use case facility to develop functional behaviors and to modify the formats to accommodate levels of fidelity required for various applications.

PRODUCTS

1. A standard English language primitives library structure that supports object oriented code development of humans and systems executing combat functions in M&S archived in the library.
2. Standard Use case format for the collection and presentation of data regarding battlefield behaviors. A separate relational database(s) will be designed to store and manage this data.
3. Use cases (approximately 50-70 use cases) for Engineer behaviors that can serve as test data.

MILESTONES SOME TASKS WILL RUN CONCURRENTLY

(Times are relative to project approval/funding)	
Primitive Research	26 weeks
Design of library	12 weeks
SME validation	8 weeks
Data input and verification	14 weeks
Develop and staff use case format	4 weeks
Research Engineer behaviors and prepare initial test use cases	5 weeks
Develop computer models of test use cases	3 weeks
Refine use case formats based on modeling	1 week
Prepare complete set of use cases for engineer behaviors	20 weeks
Develop computer models of all use cases	10 weeks
Verify and validate data through engineer SME's	9 weeks

RISK/BENEFIT ANALYSIS

1. The identification of these primitive actions is a process that, when executed once and completed, would serve almost all future Army M&S community developments.

2. It will provide a basis for on site entity level composable behavior development being planned for future Army simulations (i.e., ***OneSAF, Combat XXI, WARSIM***) that will save time and money, minimizing learning and discovery by nonmilitary experienced modelers.

3. The use case research will provide a standard documentation system and an object-oriented mechanism for rapidly developing the full spectrum of behaviors needed to provide a realistic simulation environment.

EXECUTABILITY

1. The primitive research, library development and data input will be conducted by TRAC (95%). Validation will be coordinated by TRAC with appropriate schools (5%).
2. The use case portion of the project will be executed through existing contract vehicles at the National Simulation Center.

PROJECT TITLE Development of Aggregation Standards for On-Road/Off-Road Logistical Movement in Theater-Level Warfare Simulations

STANDARD CATEGORY Move

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EXECUTIVE SUMMARY

Currently, no standard representative of the actual or real-world throughput exists for aggregating arcs (roadways) for on-road/off-road networks. Methods are available for graphically collapsing the network, but retaining the throughput properties must be examined/improved. Moreover, the modeling of throughput and the movement of logistical units is inconsistent within various simulations. This issue is important to Army Engineers as well as Logisticians. The Engineer provides support to the Logistician in evaluating the network, including determining network capacities. A standard is needed to provide a consistent methodology to create an aggregated logistics network representative of the many roads/trails that make of the actual network while at the same time providing a representative number for available throughput. The goal is to provide a standard for this area of logistical movement representation in theater-level warfare simulations (i.e. JWARS, JSIMS).

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	**$0**	**$90K**	**0**	**$90K**
Other Source(s) of Funding*	**$50K** **USACE, LOC Assessment & Repair**	**$150K** **(RDT&E)**	**0**	**200**
Total	**$50K**	**$240K**	**0**	**$290K**

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. Joint warfare simulations are currently being developed that require realistic and consistent portrayal of ground mobility. The Army Model and Simulation Office (AMSO) Standards Category Move has recommended the NATO Reference Mobility Model (NRMM) as the standard for ground vehicle movement in models and simulations (M&S). NRMM vehicle performance data has been successfully incorporated into legacy M&S and is currently being incorporated into developing M&S, providing a consistent basis for ground movement representation. Additionally, true-to-life logistics modeling within simulations is dependent on true-to-life representations of the on-road/off-road network and throughput.
2. The realistic aggregation of on-road/off-road logistical networks and the prediction/assessment of throughput performance data need to be addressed. As logistical units interact with various levels of aggregated network data, movement representation could become inconsistent within the simulation and/or between simulations linked through Distributed Interactive Simulation. This study proposes to analyze methods of aggregating on-road/off-road logistical networks as well as the interactions of logistical units of varying sizes. The goal is to provide a standard for this area of movement representation in theater-level warfare simulations (i.e. JWARS, JSIMS).

TECHNICAL APPROACH

Review simulation models and analyze the current methods of aggregating logistical networks. Investigate the movement of logistical units of varying size over logistical networks at varying levels of aggregation. . Determine a standard for the representation of logistical network aggregation for theater-level warfare simulations. JWARS and JSIMS will be the target models in implementing the results. Full coordination will be performed with system developers.

PRODUCTS

This research will result in a recommended standard method of logistical network aggregation for theater-level simulations.

MILESTONES

Analyze methods of aggregating logistical networks..2Q

Investigate the interactions of logistical units with varying levels of on-road/off-road network aggregation. 3Q

Recommend a standard for the representation of logistical networks within theater-level simulations 4Q

RISK/BENEFIT ANALYSIS

This work directly supports standardization efforts within the AMSO community and will produce a recommended standard . This proposal is being coordinated with MOVE panel, JWARS, and JSIMS. Risk in minimal.

EXECUTABILTY 100% in house

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PROJECT TITLE Development of an Extensible Hierarchy and Object Representation for Transportation Models and Simulations

STANDARD CATEGORY Deployment / Redeployment

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EXECUTIVE SUMMARY

There are several deployment tools available that model and simulate full spectrum deployment operations. Currently, unit, cargo, infrastructure, and asset data are entered into these models and simulations separately and in various formats. This results in many data inconsistencies and makes enhancing, maintaining, integrating, and interoperation between models very difficult and time consuming. This project will extend upon a common and extensible deployment/-transportation object hierarchy and library developed during FY 98. It will contains very detailed attribute data for units, military cargo, transportation assets, and infrastructure (FY99 effort) that will allow all deployment models to utilize the same (standard) set of underlying object data and would significantly reduce the effort spent to integrate models and to determine transportation system results. The object hierarchy and library will be developed using the Java programming language, which will allow for a platform-independent solution that can serve all users throughout DOD. The products produced by this effort include a detailed object design specification document for infrastructure objects and Java source code extensible deployment object library.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	FY98-$88K	100	0	188
Other Source(s) of Funding*	ODCSLOG FY 98-$32K	0	0	32
Total	$120K	100	0	220

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. Deployment of military forces to worldwide destinations has become increasingly complex and costly. Because of this fact, the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) and others are developing models and simulation systems to analyze in detail military deployments. These models are run prior to executing the deployments in order to ensure that efficient operations are conducted. The deployment models and simulation systems rely heavily on military cargo, transportation asset and infrastructure data that are needed to conduct analyses of the transportation system.

2. Currently cargo and asset data are entered into simulation models separately and in various formats. This results in many data inconsistencies and makes reusability, maintenace, integration, and interoperation of these models very difficult and time consuming. Many recent transportation and deployment model integration efforts, although beneficial to an extent, have been seriously flawed because they have lacked a common object representation that is essential for seamless interoperation. This has resulted in severe deficiencies in realizing the full benefits that object technology and related modern software practices provide. An extensible transportation and infrastructure object library, which contains very detailed attribute data for military cargo, infrastructure, and transportation assets would allow all models to utilize the same set of underlying object data and would significantly reduce the effort spent to integrate models and to determine transportation system results. This object hierarchy will also be the basis of a "bottoms-up" approach to an abstract deployment object model.

TECHNICAL APPROACH

1. After the development of a general-purpose extensible transportation object library in FY98, which will support all military models and simulation systems containing detailed unit equipment and transportation asset data, a new infrastructure object library is proposed for FY99. Just like the need for transportation standardization addressed last year, military models regularly require infrastructure data, so standardization of these data types would also be essential. This work would be complementary with efforts to standardize the military's various infrastructure databases. This library will be developed using the Java programming language, which will allow for a platform-independent solution that can serve all users throughout DOD.

2. The purpose of defining and building an extensible object hierarchy is to support simulation systems through a comprehensive object representation that contains the necessary data in-core for the simulations. This system would be key middleware that would allow connectivity between cargo item data, that is stored in back-end databases, with front-end simulation systems. Java would provide the platform-independent solution to link to back-end databases (whether they be relational or object databases) using the

JDBC (Java Database Connectivity) tool. Additional security benefits would be expected because of the inherent security features built into the Java language.

In order to develop this common infrastructure object library it will be necessary to:

1) Define infrastructure objects,
2) Determine the logical organization of the object hierarchy,
3) Identify interactions between objects through the use of object messages, and
4) Define specific object attributes that will support very detailed (area-by-area) analyses.

The infrastructure objects used at installations and seaports form a rich basis of objects central to the deployment process and will be the foundation for this continuing development effort. Almost everything that deploys begins at an installation and moves over the infrastructure. Objects included in the scope of installations and ports include:

Staging Areas

Warehouses with Truck Docks

Rail interchange, classification and loading yards

In addition to the objects, the relationships among the objects is key to understanding and modeling the behavior of those objects as they progress through the deployment process.

PRODUCTS

There will be two products of this effort:

1) Detailed object design specification document
2) Java source code extensible infrastructure object library

MILESTONES

There will be four project milestones:

1) Initial object design review
2) Final object design review
3) Completion of the object hierarchy source code
4) Completion of system testing and final delivery of object repository

RISK/BENEFIT ANALYSIS

Benefits of this approach would include:

1) Assurance of object attribute and object behavior consistency in all simulation applications that rely on the underlying object representation,

2) Reusability and portability across hardware and operating system platforms, and

3) Security features, which are inherent in the Java language.

EXECUTABILITY

The primary developers for this capability will be MTMCTEA and Argonne National Lab. A development contract is already in place between MTMCTEA and Argonne that can support this effort. The contract can be executed immediately after contract award.

PROJECT TITLE Development of Standard Infrastructure Data Structures and Interfaces for Deployment Models and Simulations

STANDARD CATEGORY Deployment / Redeployment

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EXECUTIVE SUMMARY

Deployment models and simulation systems rely heavily on data, in particular, infrastructure data, that pertain to critical nodes and links in the defense transportation system. Currently infrastructure data is entered into models and simulation separately by model and in various formats. This results in many data inconsistencies and makes interoperation and integration of models based on a consistent and common set of infrastructure data difficult and very time consuming. This project will develop a standard infrastructure data structure/interface and data library for deployment models and simulations. The library would consist of standardized (1) data table definitions, based on a relational format, (2) infrastructure entity definitions, (3) entity attributes, (4) attribute units, (5) indices for referencing the data tables, and (6) an infrastructure data dictionary. This project proposal leverages off of the significant efforts that have been devoted to the problem of detailed infrastructure data representation in the development of recent detailed deployment models and simulations, which cover major portions of the defense transportation system. The products of this effort will include a detailed data specification document that fully describes the structure of the infrastructure data and a representative infrastructure database in an MS Access database.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	0	100	0	100
Other Source(s) of Funding*	0	0	0	0
Total	0	100	0	100

BACKGROUND AND TECHNICAL DESCRIPTION

1. Deployment of military forces to worldwide destinations has become increasingly complex and costly. Because of this fact, the Department of Defense and the Army are developing models and simulation systems to analyze military deployments. These models are run prior to and in conjunction with deployments in order to ensure that deployment and logistics operations are conducted in the most effective and efficient way. Deployment models and simulation systems rely heavily on data, in particular, infrastructure data, that pertain to critical nodes and links in the defense transportation system. Nodes include sea and aerial ports of embarkation and debarkation, military installations from which forces originate, terminals, depots, bridges, and tunnels. Links comprise road, rail, and inland waterway networks. Consideration of the capabilities and the potential for bottlenecks at these nodes and links is a critical component of any analysis of the defense transportation system.

2. Currently infrastructure data is entered into models and simulation separately by model and in various formats. For example, MTMCTEA utilizes Geographical Information Systems (GIS) to collect and store infrastructure and transportation related data for various regions. While GIS contains useful data for use in models and simulations, it is only one source of infrastructure data and in most cases contains more data than needed by models and has a data structure that is not efficient for use by most models. This results in many data inconsistencies and makes integration of models based on a consistent and common set of infrastructure data difficult and very time consuming. Many recent transportation and deployment model integration efforts, although beneficial to an extent, have been seriously flawed because they have lacked a common or standardized data representation for the infrastructure, which is essential for seamless interoperation, integration, and consistent outputs among models. This has resulted in severe deficiencies in realizing the full benefits that data standardization and related modern software practices can provide.

3. A standardized infrastructure data structure, interface, and library, which contains very detailed attribute data for deployment and transportation-related infrastructure would allow all models to utilize the same set of underlying infrastructure data and would significantly reduce the effort spent to integrate models and to determine transportation system feasibility and results.

TECHNICAL APPROACH

A new, standard infrastructure data structure/interface and data library is proposed for FY99. The library would consist of standardized (1) data table definitions, based on a relational format, (2) infrastructure entity definitions, (3) entity attributes, (4) attribute units, (5) indices for referencing the data tables, and (6) an infrastructure data dictionary. The standardized database structure would be based initially on the data representations that exist in existing detailed seaport (Port Simulation), installation (Transportation Systems Capability), and theater network (Enhanced Logistics Support Tool) models. This proposal leverages off of

the significant efforts that have been devoted to the problem of detailed infrastructure data representation in the development of these systems, which cover major portions of the defense transportation system.

In order to develop this standardized transportation infrastructure data library, it will be necessary to:

1) Define key infrastructure elements for which the data structures/interfaces will be standardized,
2) Define specific attributes that will support the detailed infrastructure representation required by the simulation models,
3) Identify the appropriate units for each data attribute,
4) Determine the logical organization of the table structure and define appropriate indexes for accessing individual tables, and
5) Build a representative infrastructure database in accord with this standardized data representation.

The relationships among the infrastructure entities is critical to understanding and simulating the impacts of the infrastructure on the deployment process. Entity relationships will also be an inherent part of the database.

PRODUCTS

There will be two products of this effort:

1) Detailed data specification document that fully describes the structure of the infrastructure data.
2) Representative infrastructure database in an MS Access database.

All deliverables can be made generally available throughput DOD by posting them on the world-wide-web, if desirable. The Access database could be made to be downloadable to remote sites.

The FY99 effort will include the development of standardized data structures for PORTSIM, TRANSCAP, and ELIST nodal definitions. Follow-on development will be as follows:

FY00: Begin standardizing data structures for ELIST network elements. Standardize data for Coastal Integrated Throughput Model (CITM).

FY01: Complete standardizing data for ELIST network elements.

MILESTONES

There will be four project milestones:

1) Initial data design review
2) Final data design review.
3) Completion of the MS Access database, for a representative infrastructure data sample.

RISK/BENEFIT ANALYSIS

Benefits of this approach would include:

1) Assurance of infrastructure data consistency in all simulation applications that rely on the underlying infrastructure data representation, and
2) Web accessibility for infrastructure data standards and demonstration database.

The risks appear to be negligible, as the computing technology is in place and sufficient experience exists with the infrastructure data and the needs of deployment simulation models.

EXECUTABILITY

The primary developers for this capability will be MTMCTEA and Argonne National Lab. A development contract is already in place between MTMCTEA and Argonne that can support this effort. The contract can be executed immediately after contract award.

PROJECT TITLE The Influence of Vehicle Geometry on Maneuverability Within the NATO Reference Mobility Model (NRMM)

PROJECT PRIORITY Move

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EXECUTIVE SUMMARY

The NRMM is the NATO standard reference model for evaluating/simulating vehicle off-road performance. The model evaluates vehicle performance as a function of various interactions between dimensional aspects of a vehicle (size, weight, power, acceleration, braking, geometry, etc) and interactions with aspects of the terrain (soil strength, slope, vegetation size/spacing, obstacle size/spacing, etc). In the next century, the more mobile US military will be required to greatly increase the maneuverability of its forces in order to achieve quick strikes and rapid resolution of world-wide contingency operations. The current NRMM does not adequately predict off-road maneuver performance of non-standard or oversized vehicles, such as the M1000 HETS or other trailered equipment systems. Unique attributes of this geometry of these vehicles and interactions with vegitated or obstacle-scattered terrains, or very high degrees of curvatures such as those found on trails/off-road in undeveloped or underdeveloped countries, are not properly modeled within the current version of NRMM. The purposed project will develop maneuver relationship with increased sensitivity to unique vehicle attributes that will provide enhanced prediction capabilities of NRMM in off-road maneuver operations.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	**$0**	**$150K**	**0**	**$150K**
Other Source(s) of Funding*	**0**	**0**	**0**	**0**
Total	**0**	**$150K**	**0**	**$150K**

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

Currently the military acquisition and modeling/simulation communities utilize basic vehicle geometries in models such as NRMM to evaluate/simulate the performance of off-road vehicles. In most cases these attributes suffice to provide real or realistic predictions of vehicle performance. However, in some cases these models do not accurately predict certain interactions with the terrain that provide corresponding performance with the more traditional designs. For example, the M1000 trailer is supported by a number of small "dolly" wheels that are suspended on arms only 4-6 inches above the operating surface. On paved roads, performance is not affected. However, in initial off-road use in soils these arms drag the ground and greatly increase vehicle resistance, decreasing the actual performance of the vehicle, which is not reflected in model/simulation output. In other words the vehicle should be immobilized or near immobilization in the NRMM model predictions, but false representation of the interference indicates a non-problem. Such inaccurate performance predictions provide false representation of the maneuver potential of US forces which could lead to disaster.

TECHNICAL APPROACH

This project will result in a module of NRMM that incorporates AMSAA's maneuver methodology for long-trailered vehicle systems, NGIC's test/evaluation of US and foreign over-sized vehicles (M1000 HETs, etc), and WES's modeling of off-road vehicle performance into an enhanced maneuver prediction methodology for unique of odd-sized transporting combat/engineer support vehicle. The study will include several phases:

Phase 1. Rewrite, modify, and install AMSAA's maneuver-enhanced program into a NRMM-compatible module.

Phase 2. Collect and incorporate field test/evaluation data on odd-sized US and foreign military vehicle systems that have exhibited non-conformance with current NRMM predictions.

Phase 3. Evaluate and modify the AMSAA code to consider the data on unusual interferences and install in NRMM.

Phase 4. The current NRMM and the NRMM incorporating the new algorithms will be exercised using a variety of different tractor trailer combinations. Results of the two model outputs will be compared, analyzed and documented.

PRODUCTS

1. A new maneuver module for NRMM that considers oversized or uniquely suspended off-road tractor-trailers.
2. Documentation of verification of the new methodology and comparison/analysis of NRMM with/without the new addition.

MILESTONES

1. Complete coding and installation of maneuver algorithm (2Q).
2. Verification of new maneuver algorithms (4Q).
3. Documentation of verification and comparison of maneuver algorithm (4Q).

RISK/BENEFIT ANALYSIS

The benefits include a more theoretical analysis of current/future vehicle maneuver, a vehicle parameterization for new vehicle acquisition, enhanced modeling accuracy for all NRMM-related analyses and documented verification of maneuver algorithm.

This is a low risk effort.

EXECUTABILITY

AMSAA, NGIC, and WES will collaborate on this in-house effort.

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PROJECT TITLE	Light Scattering for Wargames and Target Acquisition (LSWTA)
STANDARD CATEGORY	Dynamic Atmospheric Environments
POINT OF CONTACT	Army Research Laboratory Battlefield Environment Division POC: Richard Shirkey Phone: 505-678-5470 (DSN 258) Address: ARL/BE Attn: AMSRL-IS-EW WSMR, NM 88002-5501 Fax: 505-678-4449 E-Mail: rshirkey@arl.mil

EXECUTIVE SUMMARY

Light scattering from atmospheric aerosols impacts the ability of a sensor operating in the visible to acquire targets. This effect, also known as path radiance, is embodied in wargames and target acquisition models as the sky-to-ground ratio (SGR). The SGR can vary from 0.2 for snow to 25 for forested conditions; accurate SGR determinations are needed to assure a high confidence for target acquisition ranges used in wargames and Test and Evaluation. Three existing models, all developed by ARL/BE, currently exist. One in TRAC's CASTFOREM, one in MICOM's Battlefield Environment Weapon System Simulation (BEWSS), and a in-house research grade code. The AMSO standards category of Acquire has requested a standard code. To accomplish this CASTFOREM's and BEWSS's legacy models will be compared with the research grade code. A new model will be developed by extracting relevant portions from the legacy models and incorporating these with improvements determined from the research grade code and advances in the literature. This will result in a final model with fewer limitations and improved accuracy. This model, along with documentation, will be provided to both MICOM and TRAC. Potential also exists for application to NVESD's sensor performance model, ACQUIRE. The final model will also be proposed as a standard in the standards categories areas of Dynamic Environments and Acquire.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds			$65	$65
Other Sources of Funding	$40 (MICOM) $160 (ARL)			$200
Total				$265

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. Due to the scattering effects of sunlight off of particles suspended in the atmosphere (aerosols), sensors not only see view the target but also "see" this scattered light, effectively increasing the noise level of the sensor. Consequently the ability of a sensor to acquire objects in the visible is reduced by the addition of this noise. This effect, known as path radiance, depends upon the observer-target-illumination geometry. An everyday example of this effect may be seen when early morning haze or fog is present. When the sun is behind the observer, objects ahead may be fairly easily seen; however when the sun is in front of the observer, objects are much more difficult to see primarily due to the additional light scattered into the observer's eyes and secondarily due to illumination changes. Wargames, such as TRAC's CASTFOREM, and target acquisition models, such as MICOM's BEWSS, characterize the magnitude of the path radiance by a quantity known as the sky-to-ground ratio (SGR). This ratio can vary greatly; for a clear day with snow on the ground the sky-to-ground ratio can be as low as 0.2, while for an overcast day and a forested background the ratio can be as high as 25. Thus the accurate prediction of this ratio is important for both wargame scenarios and target acquisition.

2. The Army Research Laboratory has developed three codes capable of predicting this ratio: legacy models used in CASTFOREM and in BEWSS, and a research grade model used for in-house purposes. The legacy models have limitations in their ability to handle either low sun-angles or varying geometries. Thus the legacy models need to be examined with an eye to removing limitations, improving predictions and concatenation into a single new model leading to a standard in the areas of Dynamic Environments and Acquire.

TECHNICAL APPROACH

This is an extremely feasible project. Initially, a sensitivity study will be performed to compare results from the legacy models with those from the research grade model. A new model will then be developed by extracting appropriate portions of the legacy models in terms of accuracy and execution time. Further improvements will be accomplished by incorporating approximations derived from the research grade model and/or from the literature. The final model will be validated and verified against the research grade model and will be provided to TRAC and MICOM along with appropriate documentation.

PRODUCTS

A standard in the Dynamic Environments and Acquire categories for determination of the sky-to-ground ratio (path radiance effects) for use in existing wargames and target acquisition models.

MILESTONES

Q1: Discussions with TRAC and MICOM
Determination of scenarios to be used
Q2: Implementation of models
Examination of physics
Run Scenarios for each model
Q3: Inter-comparison of results
Resolution of ambiguities
Further discussion with TRAC and MICOM
Q4: Final model selected
Improvements made
Final discussions with TRAC and MICOM
Delivery of model and documentation

RISK/BENEFIT ANALYSIS

The risk is low as all three models exist and additional models are available to resolve ambiguities if necessary. The final model includes support for standardization objectives in Acquire and would be submitted as a standard in both the categories of Dynamic Environments and Acquire.

EXECUTABILITY

In-house:	30%
Contract:	65%
Travel:	5%

An existing cost-reimbursement no-fee (completion) contract under the Historically Black Colleges and Universities/Minority Institutions set aside with the New Mexico State University's Physical Sciences Laboratory would be used. This contract is active and supports task orders within a wide scope.

PROJECT TITLE Modular Terrain for Entity Level Computer Generated Forces (ModTerrain)

STANDARD CATEGEORY SAF

POINT OF CONTACT

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EXECUTIVE SUMMARY

1. Terrain correlation has been one of the most pressing interoperability issues in the distributed simulation community. Terrain miscorrelation causes a number of undesirable effects such as unfair fights among entities, degraded simulation realism, and invalid exercise results. For simulations of Computer Generated Forces (CGF), terrain correlation problems can be largely be attributed to a lack of database interchange formats and to differences in runtime terrain representations.

2. The project team will design a modular and extensible standard Application Programmer's Interface (API) for entity level CGF terrain services, implement terrain modules for two different runtime terrain representation, use The Synthetic Environment Data Representation Interchange Specification (SEDRIS) to convert data from a single source to both types of runtime representations, demonstrate the modular terrain interface with both types of runtime representations, and show that increased simulation composability and interoperability results.

3. This research will produce a prototype standard modular terrain API specification, a SEDRIS read API, a proof of principle demonstration (POP-D), and a technical report. This research will provide enormous direct benefits for future M&S applications such as OneSAF and COMBAT XXI. It also provides potential benefits to legacy CGF simulations and it supports interoperability of CGF simulations with other distributed simulations. This research directly supports standards development in several Army standards categories including Semi-Automated Forces (SAF), Terrain, and Object Management; and it indirectly supports standards development for the Architecture, Acquire and Movement standards categories.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds		$75		$75
Other Funds	$50 (TRAC)			$50
Total	$50	$75		$125

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

Problem. Terrain correlation has been one of the most pressing interoperability issues in the distributed simulation community. Terrain miscorrelation causes a number of undesirable effects such as unfair fights among entities, degraded simulation realism, and invalid exercise results. For simulations of Computer Generated Forces (CGF), terrain correlation problems can be largely be attributed to a lack of database interchange formats and to differences in runtime terrain representations. For visually oriented simulators/simulations, internal processing and graphical display of terrain databases further contribute to the correlation problems.

Architecture. The High Level Architecture (HLA) has been designed to facilitate interoperability of all type of models and simulations, as well as reuse of their components. It does not, however, ensure that the various types of synthetic environment databases used by heterogeneous simulation systems are correlated (i.e., spatially consistent).

Data Interchange. The Synthetic Environment Data Representation Interchange Specification (SEDRIS) provides a mechanism for unambiguous and loss-less interchange of data for synthetic environment databases. SEDRIS furthers interoperability significantly, however, applications will continue to use dissimilar runtime terrain representations. Some of the derived runtime terrain databases may be based on an irregular network of polygons (polygonal type) while others may be based on a regular grid (gridded type). Runtime terrain databases with similar representations may have very different resolution limitations. Correlation problems will still arise when simulations which use dissimilar runtime representations are linked together.

Composability and Interoperability. Composability and interoperability were identified as two of the three highest technical risks in OneSAF development. The limiting factor in simulation scalability is often the runtime terrain database resolution capacity. The OneSAF operation requirements document (ORD) requires that "the OneSAF architecture must be able to operate using multiple terrain database formats." The OneSAF technical analysis concludes that the architecture "should provide uniform APIs between major system partitions and enforce the consistent use of these interfaces across the system to facilitate software

maintenance and evolution." In most simulations terrain is partitioned with externally defined terrain database files.

TECHNICAL APPROACH

Overview. We propose to design and prototype a modular terrain component which will hide the details of the runtime terrain representation from an entity level CGF system. This is much like the mechanism provided by HLA to abstract away the details of data distribution management. This component will contain a standard set of terrain services which will allow the application to use the terrain database independent of the underlying terrain representation. By using such a set of routines, legacy simulations and emerging CGF systems, like OneSAF, can use different terrain formats at runtime without source code changes. This promotes interoperability and composability of simulations beyond that provided by SEDRIS and the HLA. The runtime terrain representation could also be changed internally without impacting systems which already use the existing set of standard terrain services.

Tasks. The project team will (1) study several runtime terrain formats such as ModSAF CTDB, CCTT SIF++, Multigen FLT, and Janus, (2) identify the common terrain services within entity level CGF systems, (3) examine some commonly used interchange representations such as SEDRIS, S1000, and FLT, (4) develop an API specification for a standard set of terrain services, (5) code terrain modules for two different representation using the API, code/obtain SEDRIS Read API's to provide data in both terrain formats, and (6) demonstrate and test both modules in a simulation exercise to determine performance properties and correlation.

PRODUCTS

This research will produce (1) a prototype standard modular terrain API specification, (2) a SEDRIS read API, (3) a proof of principle demonstration, and (4) a technical report.

MILESTONES

Phase 1. Preliminary API Definition (10 wks)
Phase 2. Prototype Development & Debugging (25 wks)
Phase 3. Demonstration, Testing & Documentation (17 wks)

RISK/BENEFIT ANALYSIS

This research will provide enormous direct benefits for future M&S applications such as OneSAF and COMBAT XXI by supporting composability and interoperability. It also provides potential interoperability benefits to legacy CGF simulations and it supports

interoperability of CGF simulations with other distributed simulations. This research directly supports standards development in several Army standards categories including Semi-Automated Forces (SAF), Terrain, and Object Management; and indirectly supports standards development for the Architecture, Acquire and Movement categories. This research potentially supports HLA standards development as a possible reference federation object model (FOM) terrain component. Thus, research that focuses on standards development for a CGF terrain module will provide enormous benefits. The technical risk for this prototype effort is low to moderate, primarily because of the lack of SEDRIS documentation.

EXECUTABILITY

The funds will be used to purchase ¾ of a reimbursable man-year. Equipment to support the project is available at TRAC-Monterey.

PROJECT TITLE Radar and Contrast Model Identification and Standard Development

STANDARDS CATEGORY Acquire

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EXECUTIVE SUMMARY

There are several models currently at a mature level of development that could be adopted as U.S. Army standards. These models address the areas of visual and thermal contrast modeling, and elements of radar systems. Specifically, this proposal is directed towards the development of standards in the following areas:

1. Visual contrast signatures
2. IR contrast signatures and propagation
3. Radar signatures
4. Radar propagation model

FUNDING PROFILE

$K	Prior Funding & Source	FY99 OMA	Project Total
AMIP Funds	**$0**	**$45K**	**$45K**
TRAC-WSMR mission	**$0**	**$30K**	**$30K**
Total	**$0**	**$75K**	**$75K**

Funding Details

Project	PI	Affiliation	Funding
Visual contrast signatures	Blecha	NVESD	$10K
IR contrast signatures and propagation	Driels	NPS	$10K
Radar signatures	Silk	IDA	$10K
Radar propagation model	Silk	IDA	$5K
Standards Preparation and Coordination	Velez	TRAC-WSMR	$10K

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

One of the purposes of the Acquire Standard Category group is to identify, document and when appropriate, develop models the signature, propagation and sensing of targets. These models may then be used as sub-models to larger combat simulations such as CASTFOREM and JANUS. Since these combat simulations may include a wide variety of physical sensing modalities, first level models for each has to be developed.

TECHNICAL APPROACH

Using the expertise of the Acquire Standard Category group, sources have been identified for the proposed standards listed above. These sources are in the form of mature products that will require a relatively small amount of analysis and documentation to generate the standard in that area. This project therefore, comprises five smaller tasks addressing each of the sensing modalities described. A brief overview of the technical approach used in each will be given below.

Visual Contrast Signature Modeling (W. Blecha)

The NVESD contrast model may be described as a physical parameter model and is only as accurate as the physical reflectance measurements made on the specific targets of interest. It is not within the scope of this effort to perform a verification or validation of the existing model reflectance database values. The contrast model has already been coded in Fortran. As part of this effort, however, a limited verification will be made relative to the model's manipulation of reflectance data in the model's existing database. Documentation is limited to the initial model technical paper and needs further improvement. The documentation of the model will be brought up to date and will incorporate limited model verification findings. Any changes to the code will be properly documented and tested prior to release. In addition, the NVESD contrast model source and executable code will be provided to the appropriate government agencies upon request.

IR Contrast Signature Modeling (M. Driels)

This effort will focus on a product known as Electro Optical Tactical Decision Aid (EOTDA). This AF model combines both signature and propagation features for IR and TV systems. The model will be obtained and run, providing sample input-output profiles. Documentation will be discussed and referenced. The ease of providing user input will be investigated. Sample output imagery will be generated and discussed.

Radar Signature Modeling (J. Silk)

The task will investigate the following:

1. Sources of radar signature data
    - Completeness of the data set
    - RF band
    - Target set
    - Clutter set
2. Processing appropriate to simulate various RF systems
    - High range resolution
    - Monopulse
    - Moving target indicator
    - Synthetic aperture

Radar Propagation Modeling (J. Silk)

The analysis will include working documented code that models various at the level of the fidelity of the radar range equation. Systems will include Moving target indicator (MTI), synthetic aperture radar (SAR) and ground surveillance radar.

PRODUCTS

Documented standards, and where appropriate, the models themselves will be generated for the following

- Visual contrast signatures
- IR contrast signatures and propagation
- Radar signatures
- Radar propagation model

MILESTONES

All tasks will be conducted in parallel by several investigators. The general milestones are as follows:

Task	Completion
Funding starts	January 1999
Preliminary review	March 1999
Draft standard	June 1999
Final standard submitted	August 1999

RISK/BENEFIT ANALYSIS

Since all the models being investigated are current available, little development will be needed. In some cases, only documentation and conversion to an appropriate standard format will be required. There appears little risk in obtaining the necessary code and documentation required, and the result will be to complete standard development in several areas currently used by combat simulation models

EXECUTABILITY

The three investigators will execute the project with standards preparation and administrative support from TRAC-WSMR.

1. Mr. J Silk (IDA)
2. Dr. M Driels (NPS)
3. Mr. W. Blecha (NVESD)

PROJECT TITLE Risk Management Modeling

STANDARD CATEGORY FDB

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EXECUTIVE SUMMARY

In recent wars, the US Army suffered more losses from accidents than from enemy action but current simulations have no provision for attrition due to accidents. The WARSIM 2000 operational requirements document has such a provision but it is unfunded. Risk management (RM) is the Army's doctrinal process for protecting the force but current and future simulations have no provision for representing RM tasks as part of the military decision-making process (MDMP) as specified in FM 101-5, 31 May 1997. This project will fix this shortcoming of simulations by completing an on-going effort. The work and products include development of an accident data base; analysis to identify accident profiles and math equations; development and validation of risk-reduction controls and math equations; and development of RM algorithms. The products have application to task-based simulators and simulations in which the MDMP and force attrition are represented.

FUNDING PROFILE

$K	Prior Funding & Source		FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	0		$120	0	$120
Other Sources Of Funding	FY96 ARNG (Safety)	$50	0	0	$50
	FY96 TRADOC (Avn Br)	$35.6	0	0	$35.6
	FY96 USARPAC (Safety)	$30	0	0	$30
	FY96 FORSCOM (Safety)	$20	0	0	$20
	FY97 USMC (Safety)	$85	0	0	$85
Total		$220.6	$120	0	$340.6

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. The goal of Army operations is mission accomplishment with minimum losses. In recent wars, the risk of losses from accidents (including fratricide) was higher than from enemy action. Chief of Staff, Army guidance is that risk management (RM) is the principal process to protect the force and it should be a routine part of planning and executing operational missions. FM 101-5 (31 May 1997) integrates RM into the military decision making process (MDMP). The problem this project addresses is that current simulations do not model accident losses that result from poor RM. Consequently, simulations are not wartime realistic and commanders and staffs are deprived of the opportunity to learn the lesson of effective RM without paying the price of actual casualties and equipment losses. This project will complete an on-going effort designed to fix this shortcoming of simulations.

2. The problem can be described in terms of the following questions:
   - What are the significant combinations of METT-T hazards (accident profiles) that are most likely to result in the greatest loss of combat power during any given operational mission?
   - What controls can be implemented during the orders process to reduce the risk of hazards to a level consistent with the higher commander's intent and guidance?
   - How can the commander and staff best use RM in the MDMP to identify and control the risk of hazards described in the accident profiles?
   - How can simulations be best used to provide feedback to the commander and staff on how effectively they identified and controlled hazards (performed RM) during training?

TECHNICAL APPROACH

1. Realistic algorithms that reflect historical safety-related data will propagate the loss of systems and personnel if certain risk management procedures are not followed. This also aligns with the Army's training trends in building task-based simulation systems, such as WARSIM 2000 and the Close Combat Tactical Trainer. Feedback and After-action reviews also relate to the tasks that the trainers are learning in the simulation environment.

2. The Army currently requires simulations to reflect the conditions of wartime and mission tasks in the mission training plans (MTPs). Since the future simulations are going to be task-based, the best way to ensure risk management is modeled in the training and analytical simulations is to link this requirement to the appropriate tasks under the command and control battlefield operating system . This linkage will then force the simulation developer to recognize where risk management and safety models relate to the training process. In the case of semi-automated or cognitive behavioral (SAF) forces in

the simulation, the risk management tasks will be done by computer-generated forces/entities. The stimuli for these forces to react to are captured in the accident data bases and models (profiles) developed by the U.S. Army Safety Center (USASC) and which will be added to in this project. This information will drive the simulation exercise participants or SAF to apply RM practices correctly or else accidents, to include fratricide, will occur. If the commander does not want to train on RM in the simulation exercise, these models can be turned off and have no effect on the battle outcomes. However, in an era of declining resources for live training and the need to reduce accidents on the battlefield, simulations are the best way to induce training for RM and save lives and systems in combat.

3. The work to be performed includes:
   - Development of a data base for combat soldiering type accidents. (Data bases for eight other type accidents already developed.)
   - Analysis to develop profiles and math equations for the most significant tactical parachuting and combat soldiering accidents. (Profiles and equations for seven other type accidents already developed.)
   - Development of controls and math equations to reduce the risk of the following types of tactical accidents: weapons handling, materiel handling, maintenance, parachuting and combat soldiering. (Controls and equations for four other type accidents already developed.)
   - Conducting validation reviews of controls with proponent subject matter experts (SME).
   - Development of algorithms that realistically reflect significant accidents and losses of personnel and systems when hazards are not effectively identified and controlled (risk managed) during the MDMP.

PRODUCTS

1. Nine accident data bases.
2. Sixty (approximately) accident profiles and math equations.
3. Two hundred (approximately) control options and math equations.
4. RM in MDMP algorithms for use by simulation:
   - Developers
   - Trainers
   - Users (hard copy and CD-ROM training support packages are already funded and in development)

MILESTONES

WORK	1	2	3	4	5	6	7	8	9	10	11	12
Develop data base	X	X										
Conduct profiles analysis		X	X									
Develop controls	X	X	X	X	X	X	X					
Validate controls							X	X	X			
Develop algorithms									X	X	X	X
Deliver products												X

RISK/BENEFIT ANALYSIS

The benefit of standard accident data bases, accident profiles, hazard controls and RM algorithms will be realized in the ability of different models and simulations to share and reuse this information derived from real-world experience. The products have application to task-based simulators and simulations such as Close Combat Tactical Trainer and WARSIM 2000 plus STOW, JWARS and One SAF.

EXECUTABILITY

Contract	80% Existing support contract with US Army Safety Center (USASC). 80% of funds will be used for contract support.
In-house	20% USASC analysis, algorithm development and project oversight. 20% of funds will be used for TDY to validate controls with SMEs and provide project oversight.

PROJECT TITLE Standards Development for Mobilization Processing

STANDARD CATEGORY Mobilization / Demobilization

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EXECUTIVE SUMMARY

Objects do not exist in current mobilization models to represent processing of units and/or individuals through Training Centers (TCs), CONUS Replacement Centers (CRCs), or Ports of Embarkation (POEs) during mobilization. Also, a standard methodology for modeling the formation of task organized units (TOUs) does not exist. This proposal involves development of mobilization standards to identify and establish consensus on the processes, develop the algorithms, and identify the data to represent them. The ultimate goal of this project is to produce mobilization standards that can eventually be developed into standard objects representing mobilization processes.

FUNDING PROFILE

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds	$0	$91.5	$0	$91.5
Other Source(s) of Funding*	$0	$0	$0	$0
Total	$0	$91.5	$0	$91.5

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. When units and individual personnel are mobilized, they process through several activities to prepare for deployment. These activities take place at various sites that have different missions, e.g., a mobilized reserve unit would be called up at its Home Station, then move to its Power Projection Platform/Power Support Platform (PPP/PSP) for further processing, before moving to a port for deployment. For select combat units, special training is required at one of four national Training Centers (TCs) to validate the unit's training qualifications. Individual personnel report to a TRADOC Reception Battalion

and then to a Training Organization for skill validation and/or refresher training as required. Active duty personnel, mobilized reservists and civilians identified as individual fillers all move to a CONUS Replacement Center (CRC) for deployment processing. When units are validated for deployment and individuals finished processing, they move to a Port of Embarkation (air and/or sea) (APOE/SPOE) to deploy to theater.

2. Within each of the "stations" that units or individuals process through, there are several processes or activities that they must go through. Each of those activities has sub-activities that units/individuals may or may not need to process through, depending on their qualifications and requirements. All of the stations, including the activities and sub-activities that take place within a station, need to be represented as standard processes and ultimately as standard objects in mobilization modeling.

3. For a Major Theater War (MTW), most units are called up in their entirety. However, for a Small Scale Contingency (SSC), "new" units are typically formed from portions of existing units based on the contingency requirements. These "new" units are referred to as task organized units (TOUs). The component units of a TOU must undergo mobilization processing. Currently, there is no standard methodology for modeling the formation of TOUs. (Note: A TOU is mobilized just as any other unit and follows the same procedures).

TECHNICAL APPROACH

1. With the support of DA, TRADOC, FORSCOM, PERSCOM, the National Guard, and the Army Reserve (all organizations directly involved in mobilization planning for and operation of TCs, CRCs and POEs), mobilization standards for TCs will be developed. As these stations vary in size and capabilities, the standards need to be sufficiently flexible to enable all TCs, CRCs, and POEs to be included.

2. The first task will involve a review by representatives from the organizations listed above for each station type (TC, CRC, POE). The expertise of these representatives will ensure that all significant mobilization activities that take place at TCs, CRCs, and POEs are represented and represented correctly. The product of this review will be a template representing mobilization activities that take place at each type of station.

3. Once the TC template is complete, algorithms will be developed to represent each activity in the template.

4. Next, the data sets needed to execute all existing and new algorithms will be researched and identified.

5. As a separate task in the project, a methodology will be developed for modeling the formation of TOUs. The real-world process will be reviewed with the assistance of mobilization planners. Existing model representations will also be reviewed. A consensus will be developed based on these reviews.

6. Finally, the processes, algorithms and data will be proposed as mobilization standards and entered as draft standards into the Standards Nomination and Approval Process (SNAP) and Army Standards Repository System (ASTARS) systems for review and approval.

PRODUCTS

TC mobilization standards and a standard methodology for formation of TOUs.

MILESTONES

The following are the major tasks involved and associated estimated completion times:

1. Develop user consensus on mobilization processes for TCs, CRCs, and POEs – 2 months
2. Develop algorithms – 3 months
3. Identify data sources – 2 months
4. Develop methodology for modeling formation of TOUs – 2 months
5. Submit draft standards to SNAP/ASTARS for approval – 1 month

RISK/BENEFIT ANALYSIS

These mobilization standards represent the first step toward development of standard objects, which would increase the ability of mobilization models to become HLA compliant. The benefit will be the consensus within the community on the processes, algorithms, and data as standards.

EXECUTABILITY

The standards will be developed by category team members with the support of an existing contract and therefore the project is feasible.

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AMIP-99-FDB-01

PROJECT TITLE Standard Scenario Mark-up Language (S2ML)

STANDARDS CATEGORY Functional Description of the Battlespace

POINT OF CONTACT

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EXECUTIVE SUMMARY

The Hypertext Mark-up language (HTML) enables Web browsers on PC's, Mac's, Sun's, SG's, etc. seamlessly interpret machine-readable data across computing environments. The Standard Scenario Mark-up Language (S2ML) will enable constructive and virtual simulations to seam-lessly interpret scenarios across simulation environments, fidelities, and granularities. This stan-dard will capture the order of battle (units, equipment, & task organization), missions, tasks, and control measures data sufficient to completely and uniquely describe a military scenario in a computer hardware and simulation independent form. The standard will include data and meta-data for security marking the scenario contents as well as managing scenario configurations. This project will survey existing and planned simulation tools to identify essential and optional data required to initialize a computerized scenario. Then a standardized mark-up language modelled after HTML will be developed to foster scenario reuse across domains and among simulators and simulations.

FUNDING PROFILE

	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
AMIP Funds		**$76.5K**		**$76.5K**
Other Source(s) of Funding				
Total		**$76.5K**		**$76.5K**

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BACKGROUND & TECHNICAL DESCRIPTION OF THE PROBLEM

Janus, CASTFOREM, VIC, CBS, BBS, CEM, RESA, TACSIM, and the hundreds of other DoD simulations each use a unique file format to describe and initialize a scenario. Therefore, CAST-FOREM scenarios cannot be read and executed by BBS and vice versa. The lack of standardized meta-data for describing a scenario further confounds the file level data interchange problem. Lacking a standardized scenario description language, operational prose and paper are generally used to capture the initial scenario description. Then each and every simulation user must uniquely implement the paper scenario description in their simulation tool.

TECHNICAL APPROACH

1. Identify Candidate Tools in Each Domain to Survey
2. Interview code writers & review documentation to determine current & evolving scenario file contents
3. Develop a candidate standards document that captures a mark-up language for essential and optional scenario content
4. Staff the proposed standard within the Army simulation community (to include industry) for comments
5. Respond to staffing comments & concerns
6. Propose the standard in SNAP

PRODUCTS

1. Draft Standard Scenario Mark-up Language Document
2. Report of Activity & Consideration of Comments to the Draft S2ML Standard

MILESTONES

	Months After Authority to Proceed								
	1	2	3	4	5	6	7	8	9
Initial Tools Selection	-▼								
Survey Schedule Coordinated	--▼								
Initial Surveys Completed	▼---	------	--▼						
Survey Summary IPR				▼					
Draft Standard Development		▼---	------	------	--▼				
Staffing Draft Standard					▼-	-▼			
Comments Considered						▼-	-▼		

	Months After Authority to Proceed								
	1	2	3	4	5	6	7	8	9
Draft Report					▼---	▼			
Final Report							▼-	▼	
SNAP Submission								▼	
Formal Review & Staffing								▼----	--------

RISK/BENEFIT ANALYSIS

Includes potential support for standardization objectives.

S2ML takes the essential first step that would allow CAC to describe a scenario in a machine readable form that would enable Combat XXI to use the scenario for a new system AOA; WAR-SIM to reuse the scenario to support Brigade & Battalion staff new equipment training; CCTT to reuse it for crew training; and some system specific device could reuse the same scenario for in-dividual training. This level of reuse only happens when a standard language describes the sce-nario for use by a variety of tools. The Army risks perpetuating simulation unique scenario for-mats and the current costly scenario building process unless a standard is developed for wide-spread general usage outside the scope a particular simulation development effort. Using this effort and capitalizing on the knowledge captured in the WARSIM FDB efforts creates an op-portunity to develop a rapid scenario generation capability that couples standard unit composi-tion descriptions with standard missions and tasks to quickly answer training and analysis needs for warfighers.

EXECUTABILITY

This effort will be executed using the SMDC SETA contract (a one year old, five year long vehicle) building on a longstanding working relationship between STRICOM and SMDC. Contract personnel are available to immediately begin data collection & surveys.

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APPENDIX F

SIMTECH Proposals Approved to Receive FY99 Funding
(sorted by Project Title)

SIMTECH Proposals Approved to Receive FY99 Funding (sorted by Sponsoring Agency)

SIM-99-AMC-01

PROJECT TITLE Automated Universal Data Collection and Analysis

POINTS OF CONTACT

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EXECUTIVE SUMMARY

1. The emergence of High Level Architecture (HLA) as the standard for simulation interoperability has created the need to develop software tools and techniques that operate in an evolutionary new environment. Data collection and analysis are fundamental components for all modeling and simulation (M&S) activities. While HLA seeks to improve interoperability for large scale distributed simulations through the use of new technology, the data collection and analysis requirements present a unique set of problems and limitations. This project will automate the data collection process for HLA by enhancing and integrating tools developed independently by AMCOM Missile Research, Development, and Engineering Center (MRDEC) and TRAC-Monterey. The end product will provide the capability to use the data collection tool with any Federation Object Model (FOM) and set of Measures of Effectiveness (MOE) desired without recoding the user interface, data subscription methodology, or database. The tool will allow a user to decompose the experiment study questions in the native FOM terminology to derive the base data elements required for analysis. These elements will then be automatically subscribed to via the Run Time Interface (RTI) and then used to populate a database in their native FOM forms. The data elements will then be recombined to form MOE which can be graphed for the user interactively. This approach will allow even novice users to leverage HLA experiments for robust data collection and analysis in a fully automated and portable manner.

2. The MRDEC and TRAC-MTRY have developed data collection and analysis capabilities for HLA over the past few years. In the proposed project, this code will be extended and enhanced to fully automate the development of data to be collected the subscription to that data, and the display of that data all in the native FOM form. The resulting tool will be useful for a wide variety of HLA experiments because it will address the major issues of multiple FOM portability and automated data capture and processing. This fully

supports the goals of developing less expense technologies to improve Army M&S quality and developing techniques to increase interoperability among and across M&S domains by developing a completely portable and reusable data collection and analysis tool irrespective of FOM.

FUNDING PROFILE

$K	Prior funding & source	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH	$250K	$250K		$500K
RFPI	$300K			$300K
JTLS	$50K			$50K
TOTAL	$600K	$250K		$850K

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. Data collection within a distributed simulation exercise is done for exercise analysis or replay. Exercise analysis may concentrate on the behavior of a particular simulation component, or the aggregate behavior of a collection of components. This analysis can be used to assist the simulation model verification and validation process. A key benefit of data collection is the ability to review or replay a portion of the exercise at various levels of detail. A causal investigation of a particular event may be required to discover why or how something happened. Analysis or replay is usually only supported after the exercise is completed, although a data collection system can be designed to provide data queries during execution. This capability is useful to monitor the simulation execution in order to provide corrective actions when necessary. Data collection tools for large distributed simulation exercises have predominately used a logging mechanism. A logger monitors all simulation network traffic and stores the data as it is received.

2. Currently, HLA data analysis tools are designed and built to support one particular FOM and use that FOM's object representations to develop the database schema, the graphic user interface, data subscriptions, and MOEs. This approach requires the recoding of significant portions of the application to support new or revised FOMs. In some instances, developers have attempted to design a generic database schema, graphic user interface, and MOE development environment to minimize the impact of FOM changes. This approach does address the problem to a degree, but still requires additional code to map the FOM data into the generic forms and to process the data subscriptions to the RTI.

3. The tools that will be utilized for this project include the MRDEC Data Collection and Analysis Tool (DCAT), the Study Question Decomposition Tool, and TRAC's Data Subscription Processor. These tools have been developed by the AMCOM MRDEC and TRAC through a variety of funding lines, including SIMTECH. This project will attempt to develop an integrated and standardized methodology for supporting any FOM and RTI release in the future.

TECHNICAL APPROACH

1. **Develop Automated Study Question Decomposition Module:** Using the TRAC product as a baseline, we will enhance the software by using MRDEC supplied algorithms and code to automate the decomposition in the native FOM format. This module will guide the user through the process of identifying the required data to support the analysis.

2. **Develop Automated Database Schema Generator:** Using the MRDEC database tools and/or the TRAC database as a baseline, we will enhance the software by developing an automated FOM parser that will produce a valid database schema to hold the collected data in native FOM format. This module will automatically generate compiled code to interface with the rest of the application.

3. **Develop Automated Data Subscription Module:** Using the TRAC product as a baseline, we will enhance the software by automating the subscription process to the RTI and the data passing into the database. This will complete the core of the application.

4. **Develop Dynamically Customized GUI:** In order to provide the user with a FOM centric view of the data, the GUI must display the objects and interactions available in their native forms. We will use the DCAT and/or TRAC GUI as a basis for developing the dynamically customized GUI. This GUI will adapt its display to conform to the FOM representations of the data.

5. **Interface Components With Graphic Output Modules:** Using the DCAT graphic output modules as a baseline, we will allow the display of the data in its native form.

6. **Verify Performance of Agents and Tools in HLA Exercise:** Finally, the tools will be tested to ensure reliable operation in a heterogeneous networked environment

PRODUCTS

A complete data collection and analysis software package for HLA that maximizes flexibility, supports any FOM, and automates the process of determining data requirements.

MILESTONES

AFTER CONTRACT AWARD (C):

(C+90 days)	Completion of Study Question Module
(C+120 days)	Completion of Database Schema Generator
(C+180 days)	Completion of Data Subscription Module
(C+240 days)	Completion of Dynamically Customized GUI
(C+300 days)	Integration Complete
(C+330 days)	Completion of Testing
(C+360 days)	Delivery of Executable

RISK/BENEFIT ANALYSIS

Risk is moderate and benefits are high. Most development tasks leverage previous work in the field and/or COTS tools and software. The HLA RTI version 1.3 is now available, as are a number of developmental FOMs. The resulting tool will be useful for a wide variety of HLA experiments because it will address the major issues of multiple FOM portability and automated data capture and processing. This approach will allow even novice users to leverage HLA experiments for robust data collection and analysis in a fully automated and portable manner.

EXECUTABILITY

Thirty percent of this effort will be performed in-house. The remaining seventy percent will be placed on existing time and materials contracts that are in effect until 2000 and have scopes of work which permit the work described above to be performed.

SIM-99-CAA-02

PROJECT TITLE Comparative Simulation State and Path Research/ Interpretation (SimPaths III)

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EXECUTIVE SUMMARY

This collaborative research continues work (by Drs. Gilmer, Robinson, and Taylor) for generating, capturing, interpreting, and exploiting multiple paths or trajectories that "span" the spaces of combat simulations under formal control. Frequent simulation, whether deterministic or stochastic, is to generate a single primal space path per "run." A long-standing goal is to capture sufficient data from higher resolution simulations to later extrapolate or interpolate to lower resolution ones. If outcome space is envisioned as a vector space, a need is for a basis set of outcomes spanning the largest practical number of dimensions. Hence, it is necessary to "manage" trajectory generation and exploration within and among runs for later extrapolation in accord with notions of dimensionality, necessity, sufficiency, and feasibility ... and efficiency. This interdisciplinary project brings together approaches for managing multiple trajectories within and among methods, models, and runs. The research is to be performed at the Naval Postgraduate School and through ARO by faculty and students of Wilkes University and the University of Wisconsin. Dr. Gilmer is to continue his research on following several different, maximally informative simulation paths within a "single run." Dr. Robinson is to develop a "dual variable" method appropriate for formalizing the dynamic selection of postures, the allocation of targets, assessment of attrition, and unit movement to replace current informal, intuitive, heuristic, and/or ad hoc schemes. Prof. James Taylor is to continue his comparison of the theories and practices of "competing methods." Collectively, the researchers are building a "tri-space" formalism: the base space is the "primal one" in which classic simulations operate; atop the base space points lie tangent spaces offering directions from base point to base point; and atop the tangent spaces lie dual spaces governing selections among tangents and, hence, paths.

FUNDING PROFILE

($ K)	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total OMA/OPA
SIMTECH	$100K to Gilmer $90K to Taylor $50K to Robinson	$50K to Gilmer	$0K	$290K/$0K
Other Source(s)	$55K CAA - Gilmer			$55K
TOTAL	$295K	$50K	$0K	$345K/$0K

BACKGROUND / DESCRIPTION OF THE PROBLEM

A theater analyst faces enormous difficulties. Theater simulations tend to be large. Serious analysis demands attention to troubling uncertainties as well as many friendly and threat alternative courses of action. CAA's approach to the weapon system attrition scope/resolution dilemma has been to use replications of a limited (division/brigade) scope, higher resolution stochastic simulation to calibrate attrition for theater level deterministic simulation. A recent CAA theater campaign analysis included more than 10,000 red or blue attacking engagements at blue full or reduced brigade level. Meaningful simulation demands representation of both standard and non-standard engagements, and, now, how digitization can help create and exploit opportunities.

Dr. Gilmer (Wilkes University) will pursue the third year of research to investigate the applicability of "multitrajectory simulation techniques" to force-on-force combat simulations. Dr. Gilmer's goal is the generation of trajectory bases that span the entire engagement domain of interest.

Dr. Robinson's (University of Wisconsin) work formalizes and extends classic notions of shadow pricing. In principle, similar notions may be moved "inside a simulation" to influence dynamic battlefield choices and decision-making about posture, target allocation, attrition, and movement -- i.e., trajectories in combat state space.

Gilmer's work emphasizes values of primal battlefield quantities, and Robinson's work emphasizes dual variables. Gilmer generates and follows paths or trajectories in the primal space by selecting from among the subset of tangents from a tangent space defined on a primal base space. The choice of tangents may depend on the application of a varying dual form also defined on the primal base space. Gilmer and Robinson benefit from each other's work by unifying their workspaces.

Prof. Taylor developed a framework for objective description and comparison of methods for determining postures, target allocations, attrition estimates, and unit movements. Taylor's

continued research will extend his framework to consideration of dual measures and application to a still larger set of approaches.

TECHNICAL APPROACH

A. Gilmer's new work extends: 1. State Distance Metrics: One of the techniques for keeping the number of trajectories manageable is to recognize when two states are very similar. 2. Trajectory Choice Policy: More advanced choice policies need to be explored that will allow tradeoffs between outcome space coverage and coverage of the possible variety of "interesting" cases. 3. Scalability: As scenario size varies, how well does the multitrajectory approach perform in terms of giving the analyst an understanding of the potential outcomes? To what extent do outcomes provide sufficient bases for engagements at greater or lesser scales?

B. Even small simulations may involve a wide variety of decisions. The means by which the current generations of simulations "choose" are diverse. Many start with a priori values of options and then choose the option that has the score that is best in some sense. Ideally, all values should be relatable to short and/or long term objectives and to abstract dual spaces. Different uses and different purposes almost always imply different dual variables and different values. Dr. Robinson has studied what are considered the classical works on linear weights, all basically derived from eigenanalyses of linear algebraic systems. He has done original work on marginal values and shadow prices for combat. He is now moving dependence on dual variables "inside" the engagement.

C. How does one tell which of two or more competing approaches is superior? The ongoing, heated arguments about what method or model to use show that the matter is far from resolution. In late 1996, Prof. James Taylor agreed to apply his expertise to the development of objective criteria for choosing among methods and models. The scope of his FY97-98 effort was limited to development of a primal variable framework and application of that framework to just three example modeling approaches. For FY99, the framework is to be extended to included dual consideration and is to be applied to additional examples.

PRODUCTS

Gilmer will develop algorithms and code and fully brief and document his work. He will discover and report probable practical limitations on addressable modeling scope and resolution. No complete new models are expected. However, the developed guidelines and examples may form the basis for modifying existing simulations and processes or for influencing specifications of new modeling efforts.

MILESTONES

IPR's and phone and email contacts will continue. IPR's typically are set so as not to conflict with researchers' classroom commitments. ARO and CAA may co-host a workshop early in 1999.

The plan is for two generations of documented products within the FY -- in February 1999 and September 1999.

RISK / BENEFITS ANALYSIS

The theoretical and practical problems and difficulty are well-known to thoughtful analysts. The proposed research introduces abstractions beyond the usual one is the modeling community. The proposed work will almost certainly provide significant improvements in the theory, practice, and understanding of deterministic, stochastic, and hybrid simulations.

The principal investigators are internationally known; the researchers are of the highest quality and, together, comprise and interdisciplinary team of rare order.

The state and path spaces of large simulations are enormous. A risk is that Gilmer's promising methods may fail before models much larger than toys are addressed

EXECUTABILITY

The Army Research Office will handle funding for Dr. Gilmer. ARO will apply its standard monitoring, review, and reporting requirements.

Almost all the actual research is to be performed by the University PI's and their grad students. CAA modelers and AHPCRC site representative (Dr. Tatalias) will participate in providing examples for consideration and in reviewing the researchers' work.

SIM-99-CAA-02

PROJECT TITLE Composable Behavior Technology Implementation (CBT)

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EXECUTIVE SUMMARY

1. This project will apply the "Composable Behavioral Technology" developed by SAIC under contract to STRICOM to object-oriented behaviors delineated in the National Ground Intelligence Center's Conceptual Model Repository.

2. Army simulations must be able to represent the doctrinal behaviors of numerous forces for multiple applications. Not only do simulations need to reflect the behaviors of our own force, but also of foreign forces who may be friendly, opposing, or neutral. The modeled behaviors must reflect current capabilities, as well as those projected for the near, mid-, and far term. Some applications, such as training, require unclassified behaviors. For other applications, a variety of classified applications are required. Thus, there is a clear need for an efficient and flexible approach to creating the multiple necessary behaviors.

3. STRICOM, in their Composable Behavioral Technology (CBT) project, has developed a vision for future SAFs that permits complex behaviors to be built from pre-programmed primitives and associated predicates. Under this proposed project, the initial STRICOM work will be extended to apply real-world foreign behaviors (as documented in object-oriented form by NGIC) for use in real-world combat models (as described by TRADOC). The project will combine the expertise of STRICOM, NGIC, and TRADOC through an integrated project team (IPT) that will direct the effort. The resulting composable behaviors will provide high fidelity ground force behaviors that will permit much greater flexibility and efficiency in developing SAF behaviors at a significant cost savings over coding multiple, separate behavior sets.

FUNDING PROFILE

($ K)	Prior Funding	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH		$595		$595
NGIC (OOA)	$554	$445		$999
STRICOM (CBT)	$402			$402

($ K)	Prior Funding	FY 99 OMA	FY 99 OPA	Project Total
TOTAL	$956	$1040		$1996

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. Army simulations must be able to represent doctrinal behaviors of foreign forces (friendly, opposing and neutral) for multiple applications. Unlike the characteristics of physical systems, military doctrine and command and control processes are not absolute. The number of different behaviors is potentially quite large. At the same time, the move away from application-specific simulations and toward multiple-use simulations intended to serve multiple applications (i.e., OneSAF) argues for maximum flexibility and a mechanism to represent:
   - Multiple doctrines
   - Changes in doctrine
   - Different applications of the same doctrine
   - Modification of doctrine to take advantage of new hardware capabilities
   - Classified and unclassified doctrinal representations

2. Numerous players in the M&S community have recognized this problem and have identified composability as a solution. The NSC, for example, listed composability as a requirement for WARSIM. JSIMS has established a Composability Task Force. And the NGIC and TSD have supported the concept as a means to accommodate the numerous possible foreign ground force representations. Both STRICOM and NGIC are conducting some preliminary efforts to support the development of composable behaviors.

3. STRICOM's CBT development focused on a small set of rotary wing aircraft doctrinal tasks. Within that context, a set of "primitive" behaviors and a set of associated predicates were identified. The primitives represent the basic set of atomic behaviors while the predicates specify the decision points within a more complex tactical behavior. The CBT composition tool permits the primitives and predicates to be packaged to create composite or complex behaviors.

4. NGIC has developed object-oriented descriptions of foreign ground force behaviors. While nearly every country in the world (some 180+) has some form of ground forces, analysis of battlefield functional areas has shown that the employment of a given country's ground forces can be mapped to a much smaller set of behavioral paradigms: a Russian paradigm, a British paradigm, a U.S. paradigm, for example. Via this approach, NGIC has developed a limited number of conceptual models that describe foreign ground force behaviors. These descriptions will serve as the "universe" of behaviors to populate a composable behavior tool.

5. The focus of this initiative is to combine the results of STRICOM's preliminary CBT research with the NGIC's foreign behavior descriptions to determine whether and how STRICOM's CBT can be used to provide diverse, real-world foreign ground force behaviors for Army use.

TECHNICAL APPROACH

This project will be directed by an IPT consisting of representatives from at least NGIC, STRICOM, and TRADOC. The IPT will identify a subset of behaviors from NGIC's conceptual models to be implemented in STRICOM's CBT.TRADOC will review these behaviors for applicability to U.S. Army analytic and training needs and will determine whether the list is adequate for the effort.

STRICOM will:

1. With NGIC and TRAC subject matter experts, extract and analyze the primitives and predicates required to support the identified list of behaviors.
2. Design and implement the resulting list of primitives and predicates.
3. Develop CBT to include:
   - Access to increased set of primitives and predicates as required to support the list of identified behaviors.
   - A graphical user interface (GUI) to support subject matter experts in the creation of complex behaviors.
4. With support and review by NGIC and TRAC subject matter experts, implement the list of identified real-world foreign ground force behaviors using the developed primitives, predicates, and composition tools.
5. Develop transition plan for injecting the results of this work into OneSAF.

Cost Breakout: NGIC - $30K; TRADOC - $95K; STRICOM - $500K (TOTAL - $625K)

PRODUCTS

A set of primitive behaviors and the associated predicates. An enhanced GUI for creating complex behaviors from the set of primitives. Implemented CBT on diverse forces. A transition plan for injecting the results of this work into OneSAF.

MILESTONES

MILESTONES	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Preliminary identification of behaviors		X										

MILESTONES	MONTHS											
Behavior set completeness review and IPT approval			X									
Completed behavior analysis and identification of required primitives and predicates						X						
Completed development of GUI to accommodate new elements									X			
Implementation of all primitive and predicate modifications in existing CBT										X		
Implementation and composition of identified behaviors in CBT											X	
Assess results											X	
Produce transition plan												X

RISK/BENEFIT ANALYSIS

This project builds on earlier composable behavioral work at STRICOM that has shown tremendous promise. It uses existing real-world behavioral descriptions that need to be modeled. It is directed by an IPT to which NGIC, TRADOC and STRICOM are committed, but will be open to any other agency that wishes to participate. The ODCSINT and others concerned believe there is very limited risk in this project, and potentially very large cost savings based on the establishment of a set of reusable behavior primitives and predicates and the resulting increase in efficiency of developing behaviors.

EXECUTABILITY

This effort can be executed through an existing STRICOM contract with the participation of NGIC and TRADOC.

PROJECT TITLE Enhancement to Theater Air Defense Analysis Cluster (ETADAC)

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EXECUTIVE SUMMARY

This project proposes enhancement of the Theater Air Defense Analysis Cluster (TADAC) within CAA's Simulaton Laboratory (SIMLAB) and theater campaign simulation environment by acquisition and integration of two SIMTECH funded workstations. Earlier projects made significant additions to CAA's "analyst distributed workbench," including a beginning TADAC in FY97. This new proposal for acquisition of specific hardware and software is to further improve capabilities to prepare for, execute, conduct analyses, record, document and display results of theater air defense (especially theater missile defense) as parts of CAA theater campaign analyses. Demands for theater air defense analyses have grown in direct proportion to concerns about threat weapons of mass destruction (WMD), delivery options, defense options, "leakers," and effects on theater air and ground campaigns. Uncertainties in all these areas imply ever more extensive parametric variations to "bound" the problem and its effects. The software tool of choice is EADSIM. CAA has found that the demand for EADSIM runs exceeds current TADAC capacity. The primary effect of this proposal would be to add two SGI Octane-class workstations to the TADAC. The research aspect of what appears to be primarily an acquisition lies in designing and executing the necessary and sufficient run matrices to support air defense quantity, quality, and policy decisions and translating results to feed other members of CAA's family of theater models, simulations, pre- and post-processors, and visualization tools – in effect, to optimize cluster application.

FUNDING PROFILE

($ K)	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH	$0K / $90K	$0K	$110K	$0K / $200K
Other Source(s)	$0K	$0K	$0K	$0K
TOTAL	$0K / $90K	$0K	$110K	$0K / $200K

BACKGROUND / DESCRIPTION OF THE PROBLEM

AMIP and SIMTECH enabled CAA to overcome many obstacles in the timely performance of theater campaign analysis by supporting development and installation of an "analyst distributed workbench," basically a fully integrated network of workstations, desktop computers, and laptops. The network provides CAA analysts with a rich variety of hardware and software through connectivity – including links to CAA analysts overseas. Separately and together AMIP/SIMTECH initiatives enhanced the efficiency, timeliness, and quality of simulation-based combat research and analysis. In FY97, SIMTECH funded creation of a two-workstation, workbench-resident Theater Air Defense Analysis Cluster (TADAC) tailored for application of EADSIM. The demand for EADSIM runs has grown with increased emphasis on theater air defense issues, missile threats, and concerns with WMD and their effects. Current and projected demands exceed on-site and timely off-site capabilities. It appears that the only effective way to address the relevant air defense options and uncertainties is by extensive parametric analyses with EADSIM alone and as part of a multi-model iterative chain.

TECHNICAL APPROACH

The approach is to build directly on past successes in implementing and applying EADSIM on high performance workstations. From the hardware point of view, the approach is risk-free “more of the same.” The enlarged, enhanced TADAC fits directly within CAA’s distributed analyst workbench with access to other hardware and software, particularly large-scale data services.

PRODUCTS

The visible "product" will be an enlarged, enhanced hardware cluster. More importantly, the intellectual product will be a capability to address many more of the serious issues plaguing current air defense and WMD analyses. Assuming that analysts will be clever enough to make effective parametric run designs, the plethora of assumptions driving current missile defense and WMD issues will be addressable with near to full thoroughness. Nevertheless, many tough decisions will remain.

MILESTONES

1. On receipt of funding authorizations, CAA submits purchase requests to DSS-W within two to three weeks. DSS-W lead time to contract award is uncertain.
2. Delivery is usually within 30 days of contract award.
3. Following delivery, CAA staff install and complete tests within one to four weeks.
4. CAA analysts can begin productive application within days of test completions.

RISK / BENEFITS ANALYSIS

The hardware / software risks are minimal; the hardware and software technology already has been checked. At least two more CAA analysts will have to become EADSIM-qualified.

Bottom line, as usual, is extent to which quality and timeliness of CAA study and analysis products are enhanced. Strong evidence of improvement will be extent to which CAA briefings and reports include comprehensive, clear, and convincing multivariate, multi-case results. Much of what CAA's air defense team does "feeds" other CAA teams, models, and processes integrated within the scope of "theater campaigning." In principle, analysts and clients will be able to work and "see" in a broader context that includes deeper attention to scenario, model, and process sensitivities.

EXECUTABILITY

All technical tasks are to be performed by CAA staff with the advice of vendor technical support. CAA staff already have first hand experience with current versions of the items to be acquired.

It is expected that acquisition will be made through DSS-W. DSS-W has granted CAA greater procurement authority and, supposedly, has streamlined its own internal process.

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SIM-99-TRADOC-02

PROJECT TITLE Intelligent Agent Based OPFOR

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EXECUTIVE SUMMARY

The intelligent agent based OPFOR (called Smart Enemy Agent) is an adaptive intelligent embedded software that can emulate the entire range of enemy threats, subject to arbitrarily specified enemy doctrine, conflict intensity, battlespace and commander personality mix. NASA/JPL has developed a multi-paradigm command decision modeling prototype architecture and testbed environment by leveraging both state-of-the-art technology and existing software. This effort was completed in FY98 and will form the foundation of the proposed intelligent agent software development effort. The ability to represent the full spectrum of command decision making behavior in a single combat simulation by incorporating multiple technologies offers the most promise for being able to replace human controllers in simulations. This project will be executed under an existing NSC research contract with NASA/JPL.

FUNDING PROFILE

$K	Prior Funding	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH		$200	$150	$350
TOTAL		$200	$150	$350

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

The intelligent agent based OPFOR (called Smart Enemy Agent) is an adaptive intelligent embedded software that emulates the entire range of enemy threats, subject to arbitrarily specified enemy doctrine, conflict intensity, battlespace and commander personality mix. The

smart enemy agent, given a directive in the form of an Operations Order or a Fragmentary Order, imposes competent operational or tactical sustainment and employment behavior on the force it controls to achieve directive goals while husbanding resources. The intelligent agent automatically generates a stochastic, situationally constrained, enemy force disposition.

Planned characteristics of the smart enemy agent include:

- Accepts and interprets military orders
- Produces unit actions consistent with that those selected by military professionals
- As a flexible, adaptive embedded software system, accommodates arbitrarily specified: enemy doctrine (single or disparate multiple threat forces) and commander personality attributes
- Reports to superordinate level of command, and can display rationale for behavioral choices
- Has no *a priori* requirement to emulate military staff or command decision making procedures
- Operates within constraints of meta-parameters dictating limits competency, duration of decision cycle and planning horizon, and "personality" traits such as risk attitude

TECHNICAL APPROACH

1. NASA/JPL has developed a multi-paradigm command decision modeling prototype architecture and testbed environment by leveraging state-of-the-art technology and existing software. This effort will form the foundation for the proposed intelligent agent effort and it includes:

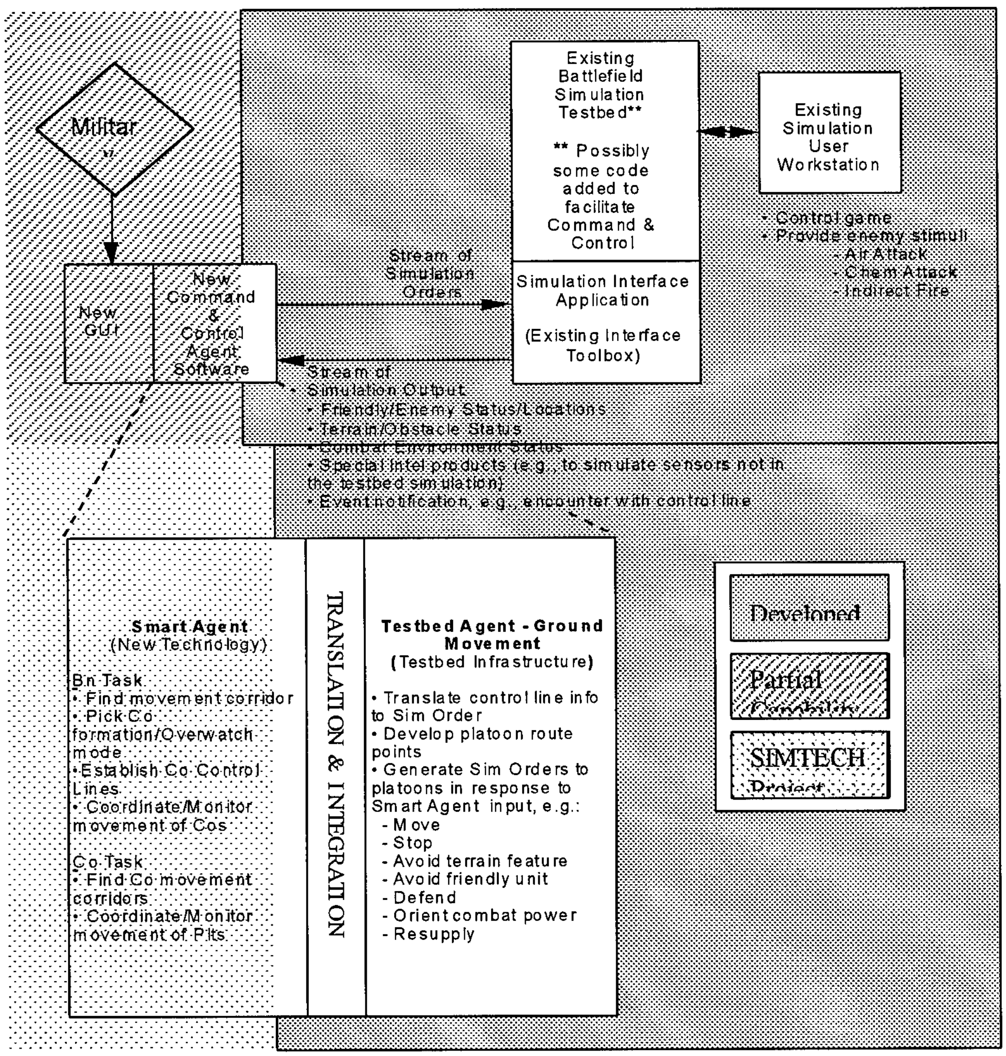
    - Intelligence Template Toolkit
    - Doctrinal and non-doctrinal templating algorithms to electronically capture enemy behavior
    - Force Template Encoding
    - Machine representation based on advances in stochastic integral geometry and geometric probability theory for encoding doctrinal templates and enemy commander behavior
    - Force Structure Analysis
    - Hypergraph theory-based, situation dependent, tactical posture generating algorithms
    - Force Alignment Module
    - Local warping due to strategy, order of battle, and terrain with attrition computed using neural network learning algorithms
    - Force Location Prediction
    - Intelligent conditional placement of critical enemy entities based on real-time interval analysis
    - Dynamic IPB Reasoning

- Statistical distribution of enemy doctrine and behavior evolution based on complex stochastic attractors and creative dynamics under varying contexts
- Smart Warping Module
- Situational and decision template final layout inspired on electrodynamics modeling
- See diagram of the existing environment and proposed SIMTECH effort on following page.

PRODUCTS

1. Simulation-independent hierarchy of OpFor C2 Smart
2. Algorithms for incorporating commander personality mix in dynamic battlefield context.

Overview of Architecture



MILESTONES

September 1998 – January 1999 -- Simulation independent OPFOR C2 Battalion Commander for ground combat training simulations
February – August 99 -- Demonstrate adaptivity to range of enemy doctrine and commander personalies

RISK/BENEFIT ANALYSIS

The proposed approach to represent the full spectrum of command decision making in one combat simulation offers the most promise for replacing human controllers in simulations. This capability is fundamental to meeting the Army's need to reduce the number of OPFOR human controllers at simulation driven exercises.

EXECUTABILITY

This project will be executed under an existing NSC research contract with NASA/JPL. Cost Breakdown: NASA/JPL $350K

SIM-99-SARDA-01

PROJECT TITLE Joint Simulation Support Environment Development (JSSED)

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EXECUTIVE SUMMARY

1. For the past 2 years, the Army has participated in the OSD led Joint Modeling and Simulation System (JMASS) initiative. The JMASS initiative seeks to establish a joint simulation support environment (SSE) to promote M&S reuse within the DOD. Past efforts include a number of pilot projects to determine the potential of such a system to meet service needs and to identify specific requirements. Several projects supported Army decision-makers and provided Army input into the Joint Operational Requirements Document (JORD) development process. Recently, the Services agreed to establish a Joint Program office to develop a SSE meeting JORD requirements.

2. This proposal meets each of the five SIMTECH goals. The proposed SSE will provide state of the art tools, services, and standards that support the full range of simulation activities. The SSE standards and tools will improve M&S development and modification techniques. Model design standards and a set of user-friendly tools, intended to ease implementation, will ensure M&S more easily and accurately represent complex processes. The technology will reduce costs to maintain and improve M&S quality by facilitating easier model development and by enabling reuse among disparate organizations. This environment will increase M&S interoperability among and between domains by including tools to support development and use of HLA compliant simulations.

3. This proposal focuses on three efforts: 1) risk reduction through technology evaluation, 2) development of a new visual programming tool to support model development and 3) development of a range of tools to support visualization of simulation results during execution. These tools will shorten the M&S develop/debug cycle and improve the quality of the models.

FUNDING PROFILE

($K)	Prior Funding	FY 99 OMA	FY 99 OPA	Project TOTAL
SIMTECH	400	150	0	150
Other	AF 250	AF 6.8M	0	AF 6.8M

($K)	Prior Funding	FY 99 OMA	FY 99 OPA	Project TOTAL
	Navy 250 OSD 500	Navy 150 OSD 150		Navy 150 OSD 150
TOTAL	1.4M	7.25M	0	7.25M

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

For the past two years, the Army has participated in an OSD initiative to establish a joint simulation support environment (SSE). Efforts to date have included a number of pilot projects to determine the potential of such a system to meet Army needs and to identify specific requirements. These projects have supported Army decision-makers and have provided extensive input to development of a Joint Operational Requirements Document. Recently, the Services agreed to establish a Joint Program office to develop a Joint SSE that meets the JORD requirements.

The pilot projects evaluated current SSE for their ability to support simulation activities. These investigations highlighted a number of areas where development is needed to satisfy the JORD. This Proposalseeks to accomplish three objectives:

1) Risk Reduction through technology evaluation
2) Develop and demonstrate a new visual programming tool to support model development.
3) Develop and demonstrate a range of tools to support visualization of simulation results during execution.

The resulting tool set will shorten the M&S develop/debug cycle while simultaneously improving the quality of the models that are developed in this environment.

TECHNICAL APPROACH

M&S activities include a range of widely disparate activities such as model development and assembly, simulation configuration, scenario development, execution and post processing. Developing a SSE that will satisfactorily support all (or even most) of these activities, is a considerable challenge. Supporting the full range of activities requires a set of tools that work together in a user-friendly fashion, hide unnecessary complexity from the user, and is responsive to the user during all activities, including model development, scenario development, simulation set up, simulation execution, and analysis of results. This project will leverage the existing JMASS PC Prototype, which is a SSE developed by the Air Force under one of the JMASS pilot projects. The PC Prototype has integrated a subset of the desired tools into a common execution environment, but lacks the visual development and

visualization tools that is the focus of this project. The project will investigate alternatives that meet the JORD objectives for desired capability and use of standards to provide those capabilities. The desired set of tools will be developed, leveraging existing technology when possible, then demonstrated as an integral component of the PC Prototype.

PRODUCTS

Products will be prototype visual development and visualization tools. These will lead to production quality tools for integration into future JMASS systems.

MILESTONES

The following milestones are based upon funding being available at the beginning of FY99.

January 1999: Complete investigation of alternatives.

August 1999: Demonstrate prototypes.

RISKS/BENEFITS ANALYSIS

As mentioned above, the primary risk involved in development of a SSE is the successful integration of a full suite of support tools, services, and standards into a responsive, user-friendly environment. If successful, the results will be a common simulation support environment for the DoD that makes all simulation activities easier to accomplish. This environment would simplify and lower the cost of implementing Army M&S standards. In addition, it will enable interoperability and reuse of M&S between the services as well as between different organizations within each service. In this era of increasing reliance on simulation, as evidenced by Simulation Based Acquisition, and decreasing budgets, extensive interoperability and reuse across and between services is critically important. Achieving this level of interoperability and reuse without a common SSE such as JMASS, will incur higher costs and greater difficulties.

EXECUTABILITY

This project will be executed through contracts administered by the joint JMASS System Project Office. This office will be stood up on 1 October 1998, replacing the current Air Force JMASS System Project Office, which is currently working to establishing the necessary contracts.

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SIM-99-AMC-03

PROJECT TITLE Modeling and Simulation Structure for Information Operations Analysis

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EXECUTIVE SUMMARY

1. The importance of Information Operations (IO), the activities affecting an opposing force's perception of the battlespace by manipulating information it needs to make its decisions and the corresponding defensive countermeasure activities, is widely acknowledged. Information Dominance is a major component of Army After Next; however, M&S structure to support analysis of IO alternatives and their effectiveness is less mature than corresponding structure in the areas of attrition, target acquisition, etc. This project will remedy that by establishing an IO analysis structure and process via a collaborative effort of the US Army Research Laboratory, the US Army Materiel Systems Analysis Activity, and the US Army Communications and Electronics Command RDEC. If continued a second year, TRADOC elements will be added.

2. AR5-11 includes "(1) Improve M&S development and modification techniques. (2) Ensure Army M&S more easily and accurately represent complex processes. (3) Develop less expensive technologies that maintain or improve Army M&S quality. (4) Develop techniques that increase M&S interoperability among and between domains." as SIMTECH goals. This project provides components for improved M&S development in IO, more accurately accounts for IO effects in Army M&S, replaces an existing network model with one less expensive to maintain, and provides tools of immediate use in RDA and ACR and potential value to TEMO.

FUNDING PROFILE

$K	Prior Funding & Source	FY99 OMA	FY99 OMA	Project Total
SIMTECH Funds	0	$151.5	$66.5	$218
ARL, CECOM, AMSAA mission	0	$387.5	$0	$387.5
Total	0	$539	$66.5	$605.5

SIMTECH Funds divided ARL/CECOM/AMSAA as $125K/$62.5K/$62.5K; mission money as $250K/$75K/$62.5K. Second year TBD.

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. The importance of Information Operations and the goal of Information Dominance require a cost-effective capability to model IO and account for its effect in combat. Combat simulations that assume perfect knowledge or communication are useless in assessing IO; the opposite extreme of explicitly representing the time history of every bit of information is prohibitive. A major goal, then, is a method to account for the effects of IO on force-level model outcomes without explicitly representing every message and every bit of information in a scenario.

2. An analogy with munition effects may clarify: Engineering level modeling of a munition impacting a target accounts explicitly for the effect of penetrator, warhead fragments, spall, etc. Design factors affecting warhead performance (or, conversely, target survivability) are studied in detail. However, in force-level models, one cannot usually afford to model at the fragment versus component level; so one settles for simpler measures like probability of kill given a hit.

3. Similarly, cost effective representation of IO in force-level models dictates a simplified IO model that avoids inessential bit-by-bit accounting for the information affecting a decision while still remaining sensitive enough to the major factors to be useful for answering expected questions of IO studies. (e.g., What delay times cause significant loss of force effectiveness? How much information would be corrupted by a virus? What protect measures are effective? etc.)

TECHNICAL APPROACH

The plan will include a top-down requirements generation and a bottom-up model-building and tool linking approach. A sketch of the plan:

1. The force level modelers will select a scenario including IO. Negotiation with the engineering level modelers will down-select a subset of the IO measures in the scenario for which it is practical to implement high resolution models in the timeframe of this project.

2. The ARL (SLAD) engineering level modelers will develop node and processor level models of individual items of C4I equipment affected by IO measures (both attack and protect.) They will exploit lessons learned from the C2 Protect ATD conducted during the term of this project.

3. CCOM/CERDEC engineering level modelers will continue building their Next Generation Performance Model (NGPM) using the OPNET software to model the connectivity and capacity of arbitrary C4I networks. This includes the capability to "plug in" the node degradation models developed under 2. above so that the network performance metrics will reflect the degradation of IO attacks. NGPM uses OPNET to reduce modification and maintenance costs relative to the current network model SPM (System Performance Model).

4. AMSAA OR-level modelers will establish the important link between the network performance models and the force-on-force effectiveness models. All participating agencies will assist AMSAA as their expertise is relevant. The goal is to reconcile what the engineering level models can produce as performance metrics under the specified IO conditions with the data requirements for C4I system performance in the force level models on the other. Preliminary discussion with TRAC indicates that a simplified model consisting of a set of functions providing delay times, messages lost and corrupted, etc. as functions of network topology and node states may be the most practical approach, however, this proposal does not bind the researchers and modelers to a specific approach.

5. ARL (IS&TD) personnel will provide the computer science and networking expertise to implement the simplified model in 4 as HLA compliant "plug-in" for the force level models. As this development work is being carried out, the scenario with its specified set of IO measures will be used by all of the participants to test their parts of the project. If a second year of the project is approved, a pilot study will be done exercising the entire analysis structure (set of models) to answer C4I questions such as: How severe an attack by the modeled IO measures can the C4I system tolerate before force effectiveness becomes noticeably degraded? What is the payoff of various C2 Protect measures or system design or topology changes? etc.

This project will be executed with significant cross-fertilization among all participating agencies, but the major responsibilities would be: **ARL, SLAD**: Engineering and node level modeling; **CECOM, CERDEC**: Engineering and network-level performance modeling; **AMSAA**: OR-level simplified model of C4I system performance under IO attacks; and **IS&TD, ARL**: Computer science and information technology expertise for project.

PRODUCTS

"Node"-level models giving the change in node performance as a function of IO measures taken against that node by the enemy and IO protect measures taken by the node itself. **2.** Next Generation Performance Model (NGPM) with the capability to accept "node"-level models as plug-ins for representing nodes with degraded performance because of IO attacks. NGPM will provide network performance metrics for a given network topology, message prioritization scheme, IO attack configuration, etc. **3.** A simplified model that estimates

those effects of IO attack and countermeasures relevant to a force level model using as inputs such factors as network topology, message prioritization scheme, current state of nodes, etc. **4.** HLA compliant plug-in modules for use in force level models implementing the simplified C4I model design in 3.

MILESTONES

Much can be done concurrently. The first year milestones:
End of Month 1: Scenario selected and IO measures to be modeled are agreed upon.
End of Month 6: Preliminary versions of "node"-level IO effects model completed by ARL. Design of simplified OR-level model is either ready for implementation or major impediments identified and mid-course correction called for.
End of Month 9: Operational versions of node-level degradation models ready for use. CECOM NGPM network-level model accepts ARL node-level model as a "plug-in". Implementation of simplified OR-level model ready for trial.
End of Month 10: Scenario run with NGPM using node-level degradation models to generate performance metrics for calibrating/fitting OR-level model. Results assessed.
End of Month 12: Report written. HLA compliant plug-in OR-level modules available.
The second year, if funded, will bring TRAC into the project to modify a selected force level model to accept the OR-level, HLA compatible IO plug-in modules. Further refinement of the models and their linkages as well as a pilot study using the structure would follow.

RISK/BENEFIT ANALYSIS

1. Complex, multi-agency projects include the possibility of a difficulty in one part preventing the completion of the combined project. The state of IO modeling is now so primitive, however, that it is difficult to imagine an outcome that would not include substantial progress and payoff in at least several parts of the problem.

2. Full success means the Army establishes a structure for analysis that includes IO effects and has utility in all three domains. Tracing cause and effect to the engineering level would benefit RDA while correctly accounting for resulting IO effects at force level benefits all domains. Even partial success would establish personal interaction between engineers and analysts at various agencies that should lead to further M&S improvements as additional parts of IO are worked: high resolution modelers learn what force-level modelers need while force-level modelers learn what it is practical to model at the engineering level. Additional areas for IO M&S work are identified and prioritized.

3. Finally, ARL is funding academic research in IO separately from this project, but this project will benefit from and exploit any resulting useful characterizations of IO produced by that research.

EXECUTABILITY

A team of ARL, CECOM, and AMSAA personnel will direct execution of year one tasks. If year two is funded, TRAC will be added (TRAC only consults in year one). All SIMTECH funds received will be used in-house to pay salaries and necessary travel.

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SIM-99-TRADOC-01

PROJECT TITLE Simulation/Stimulation Research and Development

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EXECUTIVE SUMMARY

1. There is a critical need for effective stimulation of "go-to-war" C4ISR hardware by combat simulations (sim/stim) and for stimulation of combat simulations (with minimized human-in-the-loop intervention) by C4ISR hardware operator actions. Several initiatives in this area have produced valuable niche solutions with features that will prove to be indispensable in the eventual holistic solution to the sim/stim problem. But, there are still practical sim/stim difficulties in the provision of low-overhead Army digital leader staff training. These difficulties also impair the Army's ability to conduct analysis of the new systems, organizations, and doctrine/TTP that are required to fully capitalize on the explosive growth of digital technology. This Proposalseeks funding for the effort to collect lessons learned, define a baseline architecture for a standardized, holistic sim/stim approach for use in next-generation simulations now under development (such as WARSIM), and embody that architecture in the code of an entity level simulations testbed under joint development by the National Simulation Center (NSC) and the TRADOC Analysis Center (TRAC).

2. NSC and TRAC are building a simulation environment primarily intended to serve as a testbed for developing and experimenting with common object models, composable behaviors, and other elements that will be required of future simulations such as WARSIM, OneSAF, and Combat XXI. It is also anticipated that, in the period leading up to WARSIM and OneSAF release, the testbed could serve as an entity-based model driver for 'digital leader' staff command post exercises and Army Experiment Campaign

Plan exercises. Developing a next-generation sim/stim capability is a key part of the work which must be done to achieve these objectives.

FUNDING PROFILE

$K	Prior Funding	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH	$275			$275
TOTAL	$275			$275

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

1. The ability to interface live C4I systems with simulations allows warfighters to:
   - train as they intend to fight.
   - take models and simulations (M&S) to war

2. The use of M&S during training exercises and real-world missions better supports:
   - mission rehearsal and low overhead sustainment training
   - information provision to operational planners on weapon effects, sensor capabilities, etc.
   - operational plan development
   - distributed, collaborative planning among staff supported with C4I systems
   - live C4I system representation in simulation exercises

3. Legacy simulations require expensive hardware suites that must be located in a relatively limited number of locations. This limits access to an army that needs low-cost, distributed simulation capabilities to support training and analysis. Also, legacy system updates are resource intensive.

4. The Army needs new simulation tools to train the force now being equipped with digital communication and information processing systems. Historical "work-arounds," such as swivel chair operations or large controller cadres, are not cost effective or capable of managing the data that flows through components of the Army Battle Command System (ABCS).

5. The Army is developing simulations to address these requirements, but they will not be fielded until FY 04 at the earliest. For these simulations to meet requirements, several technology advances must first occur. The simulation development programs are not funding all the required research and development (R&D). There is implicit reliance that programs such as Combat XXI and STOW-A will develop some of the required technologies.

6. One requirement that is not clearly being addressed is sim/stim. Free text natural

language processing and voice command interface are examples of needed research. There is on-going R&D in these areas, but it is not directly linked to these simulation development efforts.

7. Other insufficiently funded R&D requirements include common object models, composable behaviors for varying levels of simulation fidelity, tools to easily and rapidly form federates assembled to support specific training or analysis needs, and a host of issues required to actually achieve a true fair fight in a distributed simulation exercise. Recognizing this problem, NSC and TRAC are jointly pursuing development of a technology development simulation testbed.

TECHNICAL APPROACH

The effort described in this proposal provides:
1. An assessment of current efforts including CCSIL/MRCI/CFOR, TSIU, RTM, PIU, Command Talk, and the sim/stim approaches used in STORM and CSTAR federations.
2. Architecture development for a standard sim/stim approach to support requirements for WARSIM and other M&S under development. This work will be linked with PEO-C3S efforts to alter Army Battle Command System (ABCS) components to better accomodate sim/stim requirements. The work will lead to further integrating HLA and DII-COE and development of a C4I Interface Reference Federation Object Model (FOM).
3. Coding the sim/stim architecture in the NSC/TRAC testbed. The product could potentially be used to support reduced overhead digital leader staff training and warfighting experiments in the years before the fielding of simulations such as WARSIM.

PRODUCT

Testbed simulation possessing ability to stimulate the full range of Army C4I systems.

MILESTONES

First Quarter FY99
  Perform research
  Develop initial C4I interfaces for FBCB2

Second Quarter FY99
  Develop use cases to insure that required functionalities are present to support experimentation
  Write C++ code and test program
  Develop initial C4I interfaces to MCS and AFATDS
Fourth Quarter FY99
  Develop initial C4I interfaces to remaining ABCS systems

Complete testing in live C4I environment
Produce report

RISK/BENEFIT ANALYSIS

Risks

- Fast track relies on a wide range of capabilities to "come together" in a relatively short time
- Failure to fund means that future simulation development will not benefit from experimentation with a holistic sim/stim architecture based on lessons learned from current sim/stim R&D. This increases the risk of failure.

Benefits

- Development of processes and methodologies for stimulating C4I systems with simulations.

EXECUTABILITY

This project will be executed jointly by the TRADOC Analysis Center at Monterey, CA (TRAC-Monterey), with support from TRAC-White Sands Missile Range, and the National Simulation Center. TRAC-Monterey will serve as the lead agency for the migration of Janus to an Object Oriented environment through existing contract vehicles. Note that this effort is not a part of the effort for which funding is sought, but it is a key enabling effort. The NSC will serve as the lead for C4I interfacing and will utilize existing contract vehicles to support the development of a digitized training capability for Force XXI. Key sim/stim research, development, experimentation, and testing (the objective of this proposal) will be conducted jointly.

PROJECT TITLE Standardization of Simulation ABCS Interfaces

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EXECUTIVE SUMMARY

Currently the Army has multiple and duplicative "black box" interfaces between legacy M&S and C4I. STRICOM is actively involved in trying to develop a standardized interface with emerging M&S (HLA) and ABCS (DII COE) architectures. This proposal is specifically for work regarding the COE Message Parser (CMP) to investigate the unique M&S requirements for tactical message parsing within the CMP software. The CMP is a key transitional technology for M&S interfaces. The CMP will bridge the gap between existing, independently developed interface message parsers and future direct database to database exchange. Preliminary work has started in this area within the WARSIM program at STRICOM. This proposal would allow prototyping between the CMP and WARSIM to determine the functionality needed to use CMP as part of a standard M&S/ABCS interface for tactical messaging. Products from this proposal have the potential to be leveraged by several M&S programs (CCTT, WARSIM, and ONESAF) and future Simulation to C4I Interfaces.

FUNDING PROFILE:

$K	Prior Funding & Source	FY 99 OMA	FY 99 OPA	Project Total
SIMTECH Funds	$0	$150K		$150K
Other Source(s) of Funding*	DISC4 $100K FY 98			
Total	$100K	$150K		$250K

BACKGROUND AND TECHNICAL DESCRIPTION OF THE PROBLEM

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Currently the Army has multiple and duplicative "black box" interfaces between legacy M&S and C4I. STRICOM is actively involved in trying to develop a standardized interface with emerging M&S (HLA) and ABCS (DII COE) architectures. This proposal is specifically for work regarding the COE Message Parser (CMP)to investigate the unique M&S requirements for tactical message parsing within the CMP software. CMP offers the possibility for M&S to use the same message processor used in ABCS. Preliminary work has started in this area within the WARSIM program at STRICOM. This proposal would allow prototyping between the CMP and WARSIM to determine the functionality needed in order to use CMP as part of a standard M&S/ABCS interface. Products from this proposal have the potential to be leveraged by several M&S programs (CCTT, WARSIM, and OneSAF) and future Simulation to C4I Interfaces.

TECHNICAL APPROACH

This proposal is specifically for work regarding the integration of the COE Message Parser (CMP) into M&S. ABCS 5.0 CMP is the targeted version, which will be incorporated into MCS Blk IV, for the prototyping effort. Preliminary work has started in this area within the WARSIM program at STRICOM. Currently WARSIM C4I is evaluating a UNIX-based CMP with limited functionality. WARSIM C4I plans on evaluating a JAVA-based CMP that has increased functionality, by integrating it in the WARSIM C4I interface and passing messages between the WARSIM C4I- Prototype (P) and ABCS systems using the CMP, specifically MCS Block IV. Measurements will be made of speed of processing, throughput, scalability and utilization of computer resources. Usability will be evaluated in respect to automated operation and parsing to data structures.

CMP integration will be done in conjunction with PM, ATCCS of which both CMP and MCS Blk IV fall under.

PRODUCTS

1. ABCS 5.0 CMP M&S detailed technical requirements
2. Test Plan
3. Test Report
4. CMP M&S Requirements
5. Report on CMP functionality in M&S interfaces

MILESTONES

October 1998	Funding and JAVA version of CMP available
January 1999	Incorporation of CMP within WARSIM C4I-P with bi-directional message processing to MCS Blk IV
February 199	Incorporation of M&S technical requirements into ABCS 5.0 CMP
March 1999	Integration of ABCS 5.0 CMP into WARSIM C4I-P and development of test plan
April 1999	Test CMP interface to WARSIM C4I -P at CTSF with MCS Blk IV
May 1999	WARSIM C4I Prototype test with same CMP at CTSF with ABCS 5.0
July 1999	Technical Interchange Meeting for M&S C4I interface developers to disseminate CMP products
September 1999	M&S CMP Requirements revision based upon prototyping experience and detailed test report

RISK/BENEFIT ANALYSIS

Delivery of funding and the JAVA version of CMP and incorporation of CMP into MCS Blk IV are the major risk associated with this proposal on impacting schedule and meeting milestones. The CMP has the potential of becoming the M&S standard interface for exchanging tactical messages with ABCS. The impact of not funding this project is that the CMP evaluation and requirements will not be completed, and that the CMP will be assessed inadequate for M&S usage resulting in duplication of parser functionality in M&S interfaces to C4I systems and reduced interface functionality.

EXECUTABILITY

STRICOM	20%	
LMIS (WARSIM)	45%	
PEO C3S PM ATCCS	15%	(Includes PM CS and PM MCS)
PEO C3S CTSF	20%	

The WARSIM contract will be leveraged for this effort on a T&M CLIN

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Standards Nomination and Approval Process

SNAP

Army Standards Repository System

ASTARS

User Manual

for the Army M&S

Standards Nomination and Approval Process

and the

Army Standards Repository System

AMSO

Army Model and Simulation Office
http://www.amso.army.mil

IST

Institute for Simulation and Training
University of Central Florida
http://www.ist.ucf.edu

APRIL 1998

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User Manual for the Army M&S Standards Nomination Approval Process and the Army Standards Repository System

SCOPE

This manual provides information for the M&S user and developer community on how to efficiently use two online systems to support Army M&S Standards Development: the Standards Nomination and Approval Process (SNAP) and the Army Standards Repository System (ASTARS).

PROPONENCY

The proponent for the *"User Manual for the Army M&S Standards Nomination Approval Process And the Army Standards Repository System"* is the Deputy Under Secretary of the Army for Operations Research, ATTN: SAUS-OR, The Pentagon, Army 102, Washington, DC 20310-0102. The functional manager is the Director, Army Model and Simulation Office, ATTN: DAMO-ZS, The Pentagon, Army 400, Washington, DC 20310-0450.

DISTRIBUTION and REPRODUCTION

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An electronic copy is maintained on the Army Model and Simulation Office (AMSO) worldwide website. The current address for the AMSO Homepage is http://www.amso.army.mil

CHANGES

To help refine future revisions or republications, submit marked up copies to the functional manager.

SPECIAL NOTES

This document is an official Department of the Army publication. It is provided for information purposes within the Department of the Army. It does not authorize procurement, nor does it legally or contractually bind the government for purchase of any goods or services.

Table of Contents

CHAPTER 1 ~ Introduction

What is the Army Standards Nomination and Approval Process (SNAP) Application?

The Standards Nomination and Approval Process (SNAP) application is a web-based tool developed for the Army Model and Simulation Office (AMSO). It is used to track, validate and vote on suggestions received from the Model and Simulation (M&S) community for consideration as new Army M&S standards.

The SNAP process begins with the nomination of a standard entered via a simple, electronic input form. Immediately upon submission, the suggestion is assigned a system generated number for tracking purposes. Now called a Standards Requirement Document (SRD), the suggestion is identified throughout the system by this assigned number, which takes the format SRD_XXXXX.

The SRD moves through the system to various organizations and people, dynamically routed depending on the standards category it affects. Many options are available along the route, to include: recategorizing the SRD; withdrawing it entirely; or allowing it to continue through the process. All comments and decisions made along the way are saved into a database for historical record.

Candidate SRDs are discussed on internet-based reflectors (mailing lists) established for each of the M&S Standards Categories to facilitate widespread review and comment. Once consensus on the SRD is reached, it is reviewed by Senior Subject Matter Experts (SMEs) who recommend approval or disapproval through the online voting system in SNAP. Final authority, however, rests with the Deputy Undersecretary of the Army (Operations Research) (DUSA (OR)). If approved by the DUSA (OR), the suggestion is adopted and integrated as a new Army M&S standard.

What is the Army Standards Repository System (ASTARS) Application?

The Army Standards Repository System (ASTARS) is a web-based electronic standards storage application that allows users to store Army M&S Standards and supporting documents and applications in a central, secure location. This provides immediate document access to anyone with internet capability and proper permission. In addition to viewing stored documents, users can search, browse, and download information.

ASTARS uses a hierarchical system of ordering to store and retrieve information. As each layer opens, you can choose another more specific topic from displayed text boxes to continue browsing down. This allows multiple standards, documents, and file types to be stored and accessed under one major subject title.

In summary, ASTARS:

- Allows for submission and retrieval of standards and supporting documents.
- Allows for editing of standards information by the appointed librarian.
- Allows multiple file types of the same supporting document to be stored.
- Allows related files to be added with the standard.
- Ensures that local files are virus checked by the appointed librarian.
- Browses documents by categories.

How do SNAP and ASTARS work together?

ASTARS can also be considered the library for SNAP. SNAP provides the capability to track simple data through a series of steps in a nomination, voting and approval process. ASTARS is SNAP's repository of standards and supporting documentation. All presentations, spreadsheets, briefings and other documentation generated and used in support of any one particular SNAP SRD is stored in ASTARS.

It is possible to access ASTARS from within the SNAP application at any time through the navigation bar. This link provides SNAP users access to supporting documentation to assist in decision making or voting. Additionally, ASTARS maintains the documentation after the SNAP approval process is closed, thus providing a central archive for each SRD.

About This Manual

This User Manual provides information needed to access and use the SNAP and ASTARS applications.

- **Introduction** acquaints users with the SNAP and ASTARS applications and explains how they interact.

- **A Tour of the SNAP Application** provides an overview of SNAP and gives guidance on how to access the information and interactive forms.

- **Standards Category Coordinator (SCC) Administration** details the responsibilities and capabilities SCCs have in the system.

- **AMSO Administration** details the responsibilities and capabilities AMSO has in the system.

- **Voting** provides quick instructions on how, as a Selected Voting member, to enter the system, and review and vote on appropriate SRDs.

- **Army Standards Repository System (ASTARS)** provides an overview of ASTARS and gives guidance on how to access the information and interactive forms.

- **Typical Work Flow** describes how an SRD would flow through the SNAP system from beginning to end.

- **Appendices** include application flowcharts, the status chain, glossary and index.

CHAPTER 2 ~ A Tour of the SNAP Application

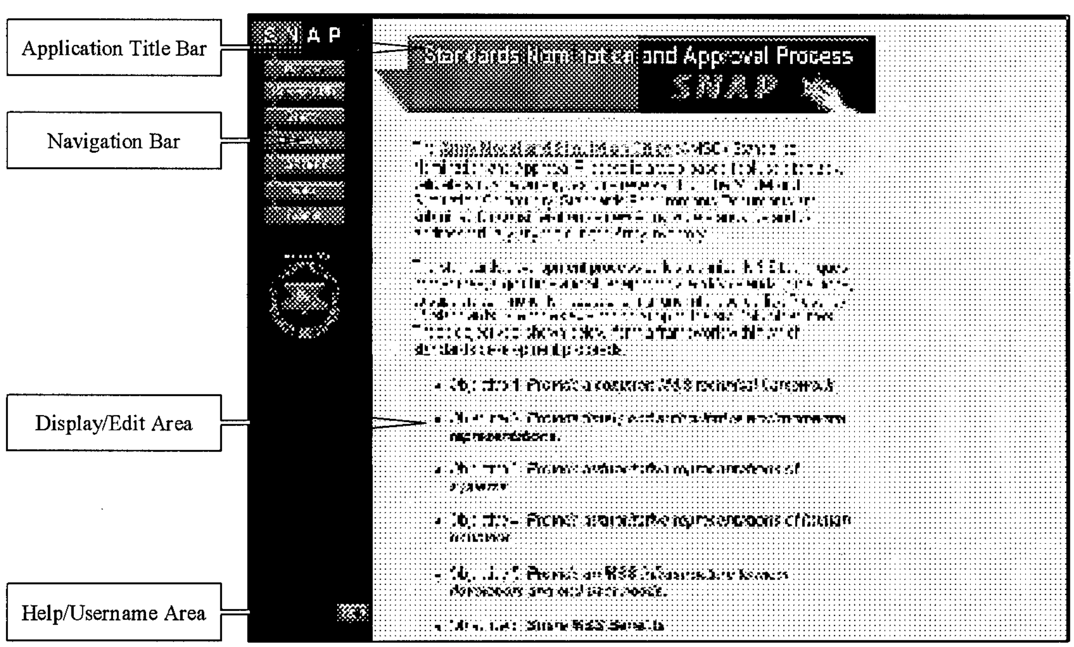
The Home Page

The home page is the entry point into the SNAP application. Located at…

http://www.snap.army.mil

The home page is composed of:

- **Application Title Bar** - located horizontally across the top of the page. This bar contains the application name and remains constant.
- **Navigation Bar** - located vertically on the left-hand side of the page. This bar contains clickable buttons to provide access to different components of the application. To retrieve the information or form you want, click on the appropriate button. The bar also includes a direct link to ASTARS. (The navigation bar will change slightly as you move through the application, offering additional buttons depending on the login entered.)
- **Display Area** - located in the middle of the page. This is the area where you will enter, edit (if applicable) or view information manipulated by the application. When you first enter the system, a brief explanation of the application is displayed here.
- **Help/Username Area** - located beneath the Navigation Bar on the bottom left-hand side of the page. The Help button is located here for assistance at all times. If you, as an SCC or AMSO Administrator are able to log in to administrative areas, your username is displayed to the left of the Help button and remains there until you log out.



Browse

When the ***Browse*** button on the navigation bar is selected, it activates the Browse page, populated with records currently active in the system. Initial submissions (not yet validated by the category coordinator), and withdrawn submissions are not displayed on this page.

In addition to the SRD number and title, the responsible standards category, current status, and status effective date are displayed for each nominated standard.

Display Options

You have the option of changing how nominated standards are displayed, specifically by sorting them by SRD Number, Current SRD Status, or Specific Standards Category. This is done by manipulating the options available on the black bar at the top of the page. From the options bar you can:

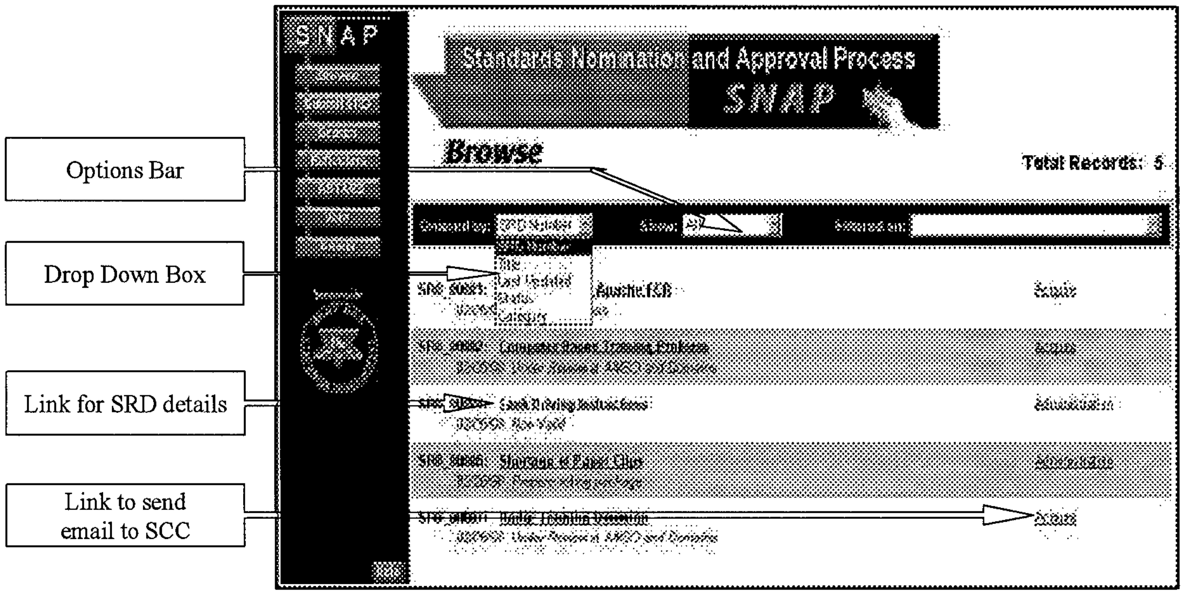
- **Change the order in which the SRDs are displayed**. When first entering the page, records are displayed in ascending order based on their SRD number (SRD_XXXXX). If you wish to display records based on their title instead, then select Title from the "Ordered by" drop down box. They can be ordered by SRD Number, Title, Status, Category, and Last Updated.

- **Change which records are shown based on status**. When first entering the page, all records are shown. If you wish to display only Approved Standards, then select Approved from the "Show" drop down box. Records can be ordered by All, Approved, and In Process.

- **Filter which records are displayed based on category**. When first entering the page, active records from all categories are displayed. If you wish to display records from one particular category only, select that category name from the "Filtered on" drop down box.

If you wish to see detailed information on any one particular SRD, select the SRD title. All information currently in the system for that record will be retrieved and displayed.

To send comments concerning any of the SRDs shown, click on the SRD's category name located to the right of the SRD record. This will allow you to compose and send an electronic mail message to the Standards Category Coordinator (SCC) for the category name selected.



Submitting a Standards Requirement Document (SRD)

When the ***Submit SRD*** button on the navigation bar is selected, it brings up the Submit SRD page. Fill in the fields as completely as possible and click the Submit button. Fields marked with a small red "R" are required fields and must be completed before the SRD can be processed by the system.

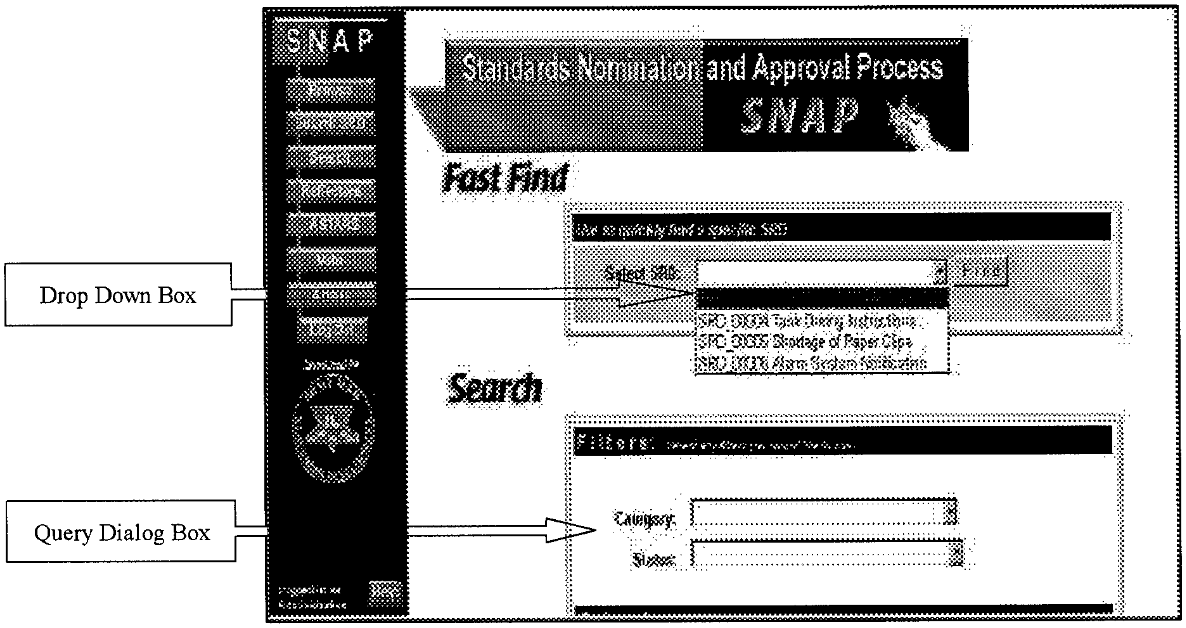
Once *Submit* is selected, if the submission is successfully processed, you will see the following message on screen:

> *Thank you for your submission. Your SRD has been assigned the following number:*
>
> *SRD_XXXXX*
>
> *AMSO and the Standards Category Coordinator have been notified of your submission by electronic mail.*

The system automatically notifies the appropriate SCC of the SRD submission through email. AMSO and the submitter also receive a copy of the generated message. The SCC will review the submission to determine if it is valid, and if so, will request AMSO to begin the approval process.

Search

When the ***Search*** button on the navigation bar is selected, it brings up the Fast Find/Search page. This page is divided horizontally into two sections.



Fast Find

The Fast Find section offers the capability to locate and display a particular record. The Select SRD drop down box lists all SRDs currently in the system by SRD Number and the first 60 characters of the SRD title. Select the desired SRD and click the *Find* button. (SRDs classified as Initial Submission or Withdrawn are not shown in the drop down box.)

Search

The search section is a Query dialog box containing AND/OR logic fields and input fields that enable you to conduct a more thorough search. You can search for SRDs within a specific category or status by selecting the desired choices from the drop down boxes. You may also search for SRDs submitted within a specified time frame by entering a date range in the ***Date Submitted*** boxes. Text searches for specific words or strings of words can be initiated by entering the words in the appropriate text boxes. Once you have entered all desired fields, effectively building the query criteria, click the ***Search*** button.

All records meeting the search criteria will be displayed in ascending order based on SRD number (SRD_XXXXX). In addition, the title and associated category for each record are shown. To view detailed information on any one particular SRD shown, click on the ***SRD Title***. All information currently in the system for that record will be retrieved and displayed.

E-Mail Reflectors

A reflector is a capability provided to users to subscribe to an electronic mailing list whereby all messages sent to the reflector are echoed to all current subscribers.

Thus, by sending a message to an e-mail reflector, all subscribers receive a copy even though the message wasn't addressed to them directly.

Reflectors are used extensively in the SNAP process as a forum for widespread SRD review and discussion. Each Standards Category has its own reflector to support the discussion and debate in the standards development process. Several messages, such as those indicating the recategorization, withdrawal or approval of an SRD, are sent automatically to the reflector for the primary standards category by the system.

The ***Reflectors*** button on the navigation bar is a link to the Army Model and Simulation Office Reflectors page. When selected, it provides access to all active reflectors.

For further information, contact the administrator shown on the reflector page.

ASTARS

The ***ASTARS*** button on the navigation bar is a link to the Army Standards Repository System application. Please refer to the ASTARS section of this manual for further information.

Voting

The ***Vote*** button on the navigation bar provides access to the senior review panel voting area. When selected, it brings up a Log On screen. Once the required username and password are validated, the system searches to see if you have been assigned to vote on more than one SRD. If so, you may select from a list the SRD you wish to vote on. If not, you are taken directly to the voting page for the one SRD. Links to the voting history and all information on file in the system for that SRD are available to assist you in making your vote.

You may enter your vote by selecting either "Yes" or "No". If you enter a vote of "No", the comments field must be completed or the vote will not be accepted. The comments are used to generate an electronic mail message to the AMSO coordinator and the SCC. If issues can be resolved by the SCC prior to closure of voting, every effort will be made to do so.

Admin

The ***Admin*** button on the navigation bar activates a Log On screen allowing you to log on as a SCC or as the AMSO coordinator by providing the correct password. Upon password verification, the navigation bar is supplemented with additional buttons depending on the login. Please see corresponding sections for further information on these buttons.

Help

Assistance is available at any time by clicking on th*Help* button located in the Help/Username area beneath the navigation bar. Clicking on Help brings up a page with the following three links

- **About the AMSO Standards Nomination and Approval Process.** Detailed text description of the application. Links are provided to access the system flowchart and the Submit SRD input form.

- **Application Flowchart.** Illustration (please see Appendix A ~ Application Flowchart).

- **Field Definition List.** Alphabetical ordering of definitions of terms used in the application. **Note:** You can gain access to field definitions by clicking on a field name in the application which opens a new window with information about the selected field at the top. If you have further questions, contact the Action Officer responsible for Standards Development at the Army Model and Simulation Office. Updated contact information is available at the AMSO homepage (http://www.amso.army.mil).

CHAPTER 3 ~ Standards Category Coordinator (SCC) Administration

Introduction

As the Standards Category Coordinator (SCC), you are responsible for reviewing and maintaining all SRDs received in your category. In addition to the functions described in Chapter 2, as an SCC you may perform the additional administrative functions explained in this chapter.

Logging On

To begin work as a SCC, select the ***Admin*** button from the navigation bar. This brings up a Log On screen prompting for Username and Password. Click on the desired category name from the drop down box and enter the appropriate password.

Upon password verification, the initial SCC administration screen indicates which category was selected and calculates how many total records are currently in the system for that category.

The black bar at the top of the screen contains two drop down filter menus. The first filter, ***Ordered by***, indicates the order the records are displayed. When the page is first entered, the records are displayed in ascending SRD number. The order in which the records are displayed can be changed by selecting one of the options from the drop down box. On the right side of the black bar is the other drop down filter, ***Show,*** that allows you to select which records are displayed based on current status. When the page is first entered, all records are selected. To narrow the record display, select another choice in the menu.

Records meeting the selected criteria are displayed on this page using alternating color bars to distinguish between them. The SRD Number, Title, Current Status Date and Current Status are shown for each record. Selecting the current status will bring up the Change SRD Status page. For further instructions on this page, see **Request Status Change** below.

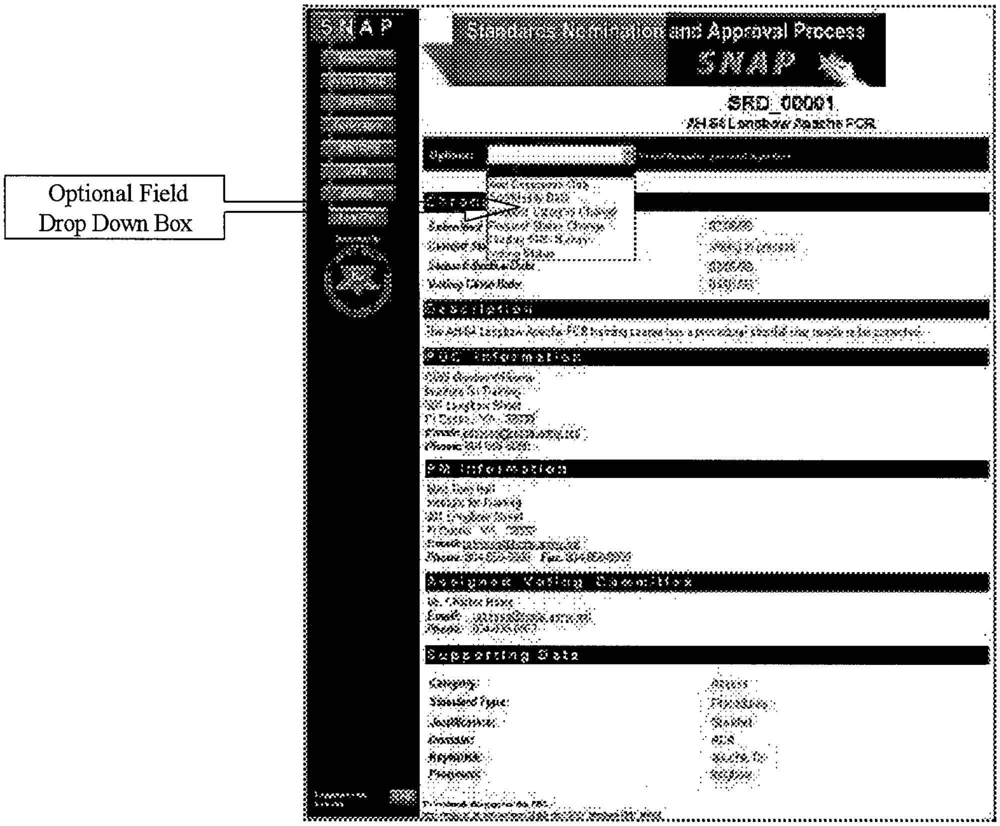
To view or edit all information pertaining to a record, click on the SRD title. This will bring up the initial record display page containing all information currently in the system for that record along with a list of editing options, as explained below.

Editing Options

At the top of the initial record display page is a black bar containing an Options drop down field. The editing options (explained below) that are available vary for each record, depending on its current status.

NOTE: If a record has a current status of Initial Submission, when the record display page is first entered an additional button labeled **Delete Submission** will appear. This option is only available for records having a current status of Initial

Submission and allows you to completely remove the record from the system without any further processing.



Add Comments Only

When the ***Add Comments Only*** option is selected, you may enter and save comments. The information entered, along with the current date, is saved as part of the historical data associated with that record.

Add/Modify Data

When the ***Add/Modify Data*** option is selected, an edit form is displayed. All information currently on file for that record is shown in editable text boxes. Any information can be changed or added, then saved. When the ***Save*** button is clicked, the record will be updated (overwriting the previous data.)

Request Category Change

The *Request Category Change* option brings up the Change Category page, which is formatted to resemble an electronic mail message. When completed, this page generates an identical mail message to AMSO requesting the SRD be changed from the current category to the category chosen from the drop down box. You must enter supporting comments in the area provided or the request will not be processed by the system.

Request Status Change

The ***Request Status Change*** option displays the Change SRD Status page which resembles an electronic mail message. When completed, this page generates an identical message to AMSO requesting the status to be changed from the current status to the status chosen from the drop down box. Supporting comments must be provided or the request will not be processed by the system.

The status selections shown in the drop down box are generated dynamically by the system based on the current status of the SRD. For help in understanding the status chain, click on ***Details***. This will show a graphic representation of potential SRD statuses as it flows through the system and indicates options available from each stage (see **Appendix B: Status Chain.**) Generally, it is only possible to select a new status one level below the current status. For a text explanation of the status chain, click on ***Further Explanation***.

After the ***Send*** button is selected, the message is sent to AMSO automatically. AMSO will review the request and determine whether or not to change the status. You will be notified by AMSO if the status has been changed.

Display SRD History

The ***Display SRD History*** option displays every action taken on the SRD since its entry into the system, along with the date the action occurred. All requests (Change Category, Change Status, etc), all comments, and all dates of activity are included.

It is possible to sort either column by clicking on the column heading.

Voting Status

If a record has a current status of Voting in Process, the ***Voting Status*** option will be available from the drop down box. When selected, the current voting results, the date voting closes for that record, and the assigned voting committee members are displayed.

You may view the voting history by clicking ***View Voting History***. This will list each assigned voter, the date they voted, their Y/N vote, and any comments the voter may have entered.

Log Off

When you have finished performing SCC duties in the system, click the ***Log Off*** button on the navigation bar. You will see the message:

You have successfully logged out of SNAP

This message will be followed by a ***Log On*** screen, providing you the opportunity to log in to the system again.

Chapter 4 ~ AMSO Administration

Introduction

The AMSO coordinator is responsible for reviewing and maintaining all SRDs received in the SNAP application. In addition to performing functions described in Chapter 2 and Chapter 3, the AMSO coordinator may perform the administrative functions explained in this chapter.

The AMSO coordinator maintains the system by managing personnel data, granting access privileges, overseeing the voting process, and configuring menus and other system displays.

Logging On

To begin work as the AMSO coordinator, select the *Admin* button from the navigation bar. This brings up a *Log On* screen where you choose *AMSO* from the drop down box and enter your password.

Upon password verification, the administration screen displays all records currently on file in the system, grouped by category, along with a total count of records that reside in the system.

The black bar at the top of the screen contains three option fields. The first option field, ***Ordered by***, indicates the order in which the records are being displayed. You may change the display order by selecting one of the options from the drop down box.

In the middle of the black bar is the second option field, ***Show***, that allows you to select which records are displayed based on their current status. When the page is first entered, all records are selected. You may narrow the record display by selecting one of the other choices in the field.

On the right side of the black bar is the third option field, ***Filtered On*** that allows the selection of records based on category. When the page is first entered, all records for every category are displayed. To narrow the record display, select a category listed in the drop down box. Only records from that category will be displayed.

Records meeting the selected criteria are displayed on this page using alternating color bars to distinguish between them. The SRD Number, Title, Current Status Date and Current Status are shown for each record.

To change a record status from this page click on the current status. This will activate the ***Change SRD Status*** page. For further instructions on this page, see **Change Status** below.

To view or edit information pertaining to a record, click on the SRD's title. This will display all information currently in the system for that record and a list of editing options, as explained below.

Editing Options

At the top of the initial record display page is a black bar containing an Options field. The editing options available from that drop down box vary for each record, depending on its current status, and are explained below.

NOTE: If a record has a current status of Initial Submission, when the record display page is first entered an additional button labeled **Delete Submission** will appear. This option is available only for records having a current status of Initial Submission and allows you to completely remove the record from the system

Add Comments Only (Same as SCC)

When the ***Add Comments Only*** option is selected, you may enter and save comments. The information entered, along with the current date, is saved as part of the historical data associated with that record.

Add/Modify Data (Same as SCC)

When the ***Add/Modify Data*** option is selected, an edit form is displayed. All information currently on file for that record is shown in editable text boxes. Any information can be changed or added, then saved. When the ***Save*** button is clicked, the record will be updated (overwriting the previous data.)

Change Category

When the ***Change Category*** option is selected, you may change the category associated with the record from the current category to the category chosen from the drop down box. You must enter supporting comments in the area provided or the request will not be processed by the system.

When the ***Save*** button is selected, the record is updated in the system. An electronic mail message is automatically generated and sent to the previous category SCC, the new category SCC, the previous reflector administrator, and the new reflector informing them of the change in record ownership.

Change Status

When the ***Change Status*** option is selected, the Change SRD Status page is displayed. This page allows you to change the status associated with the record from the current status to the status chosen from the drop down box.

The status selections shown in the drop down box are generated dynamically by the system based on the SRD's current status. For help in understanding the status chain, click on ***Details***. This will bring up a graphic representation of the status flow through the system and indicate options available from

each stage (see **Appendix B: Status Chain**). Generally, it is only possible to select a new status one level below the current status. For a text explanation of the status chain, click on ***Further Explanation***.

To complete the Change SRD Status page, you must enter supporting comments in the area provided or the request will not be processed by the system.

When the ***Save*** button is selected, the record is updated in the system and electronic mail messages are automatically sent to appropriate personnel informing them of the change.

Display SRD History (same as SCC)

The ***Display SRD History*** option displays every action taken on the SRD since its entry into the system, along with the date the action occurred. All requests (Change Category, Change Status, etc), all comments, and all dates of activity are included.

It is possible to sort either column by clicking on the column heading.

Assign Voting Members

Once an SRD moves past the Initial Submission status, ***Assign Voting Members*** will be available from the options drop down box. Selecting this option displays the ***Assign Members to an SRD*** page.

If people have previously been assigned to vote on this SRD, their names are displayed next to a checked checkbox. If no voters have been assigned, all voters registered as eligible to vote within this category are displayed with an empty checkbox next to their name.

The options available to assign voting members to a specific SRD voting committee are explained below.

Select All Voters

The ***Select All Voters*** link will assign all voters registered as eligible to vote within this category to the voting committee for this SRD.

Select Specific Registered Voters

To select only specific registered voters, click any combination of checkboxes next to the desired voters and then select the ***Assign Members*** button. Only the checked voters will be assigned to the voting committee for this SRD.

Add One Time Voter for this Specific SRD

To assign someone other than a registered category member to vote on this specific SRD, click "***Add one time voter for this specific SRD***".

The "***Add one time voter***" link will allow you to select from a list of people already entered in the system in the drop down box, or enter a new person by completing the input form. In either case, when ***Save*** is selected, the person entered on that page will be assigned to the voting committee for that SRD. **You are required to assign a username and password otherwise the voter will be unable to access the voting page.**

Any number of one time voters can be assigned to a single SRD and can be included in addition to any number of registered committee members assigned.

Initiate Voting Process

Once voting committee members have been assigned and the status changes to Prepare Voting Package, ***Initiate Voting Process*** will be available from the options drop down box.

Upon entry to the ***Initiate Voting Process*** page, all voting committee members assigned to vote on this specific SRD are listed. You can select the voting close date by clicking on the ***Pick Date*** link. This link pops up a calendar. To move to another month in the calendar, click on the month's name. To choose a closing date, click on the date. The system will automatically enter that date into the voting close date field and update the record in the system. You can also type the voting close date in the input box provided.

Once the date has been selected and you are ready for voting to begin, click on the ***Start Voting*** (Email Committee Members) button. Once selected, the system automatically generates electronic mail messages to each voting committee member informing them of their selection on this committee and providing them the URL to use to enter their vote. If the URL is lost, any voting committee member can enter a vote by accessing the system and following the instructions provided in Chapter 2, **Vote**.

Voting Status (same as SCC)

If a record has a current status of Voting in Process, the options of ***Assign Voting Members*** and ***Initiate Voting Process*** disappear from the options drop down box and are replaced by ***Voting Status***. When selected, the current voting results, the date voting closes for that record, and the assigned voting committee members are displayed.

You may view the voting history by clicking *View Voting History*. This will list each assigned voter, the date they voted, their Y/N vote, and any comments the voter may have entered.

Drop Down Menus

The ***Drop Down Menus*** button on the extended AMSO administration navigation bar activates the ***Modify Drop Down Menus*** page. This page contains four links, one for each type of menu used within the system. To edit menu information, click on the desired link.

Domains

The ***Domains*** link lists all current Army M&S domain names as they appear in drop down boxes throughout the system. The only option from this page is to ***Add a New Domain***. Click on that link, enter the new domain name, and select ***Save***. The new domain name will immediately appear in the Domain drop down boxes in the system.

Justifications

The ***Justifications*** link lists all current justifications as they appear in drop down boxes throughout the system. The only option from this page is to ***Add a New Justification***. Click on that link, enter the new justification and select ***Save***. The new justification will immediately appear in all Justifications drop down boxes in the system.

Standard Types

The ***Standard Types*** link lists all current standards types as they appear in drop down boxes throughout the system. The only option from this page is to ***Add a New Standards Type***. Click on that link, enter the new standards type and select ***Save***. The new standards type will immediately appear in all Standard Type drop down boxes in the system.

Status Options

The ***Status Options*** link lists all current status titles as they appear in drop down boxes throughout the system. The only option from this page is to ***Edit a Status Title***. Click on the title, enter the new title and select ***Save***. The new title will immediately appear in all status drop down boxes in the system and will be reflected in all SRD listings.

These status titles are used to label the stages found in the Status Chain.

Coordinators

The ***Coordinators*** button on the extended AMSO Administration navigation bar displays the SCCs for each category, the associated category, and the category password.

When the page is first displayed, all records are in ascending order based on last name. You may sort the data by clicking on the column heading.

Edit SCC Data

To view or edit any information pertaining to a SCC, click on the ***person's name*** to display the ***View/Edit Personnel Data*** page. Each field on this page is an editable text box, allowing you to change or add information. When completed, select the ***Save*** button to update the record in the system.

NOTE: There can only be one SCC per category. If a SCC changes, change the information in the current SCC record and select ***Save***. The new person is activated as the category SCC and the previous person's record will be replaced.

Change Category Password

To view or change a category password, click on the current ***password***. This will display the category name, current password, and text box for the new password. Enter the new password and select ***Save***. The new password, which is what the SCC uses to log in to the admin area, is effective immediately.

Voting Committees

The ***Voting Committees*** button on the extended AMSO navigation bar activates the AMSO Voting Administration page. This page contains the three links explained below.

View or Edit Voter Records

This link lists all Voting Committee Members in the system that have ever been registered to vote, the associated voting category, and the voter's current status

The black bar at the top of the screen contains one option field, ***Voting Committee Member Status***. This field displays records based on status (***All***, ***Active*** or ***Inactive***.) All records are initially displayed in ascending order based on the voter's last name. To change which records are displayed, select a different status from the Voting Committee Member Status drop down box. Data may also be sorted by clicking on the column heading. (Records displayed without a status indication in the far right-hand side of the page are Active).

To view or edit information pertaining to a voter, **including voter passwords**, click on the ***person's name***. This will show the ***View/Edit Personnel Data*** page populated with data contained in the system. Each field is an editable text box, allowing you to change or add information. To update the person's record, select the ***Save*** button.

Reactivate Voter

To reactivate a voter, select *Inactive* from the ***Voting Committee Member Status*** options box located in the black bar at the top of the page. Select the ***Reactivate Voter*** link on the right side of the record to restore the individual to active voting status in the category indicated.

Display Current Voting Committees

This link activates a page with a drop down box containing all the SRDs in the system that have an assigned voting committee. You must select one of the SRDs from the list and click on the ***View Committee*** button. The assigned committee for the selected SRD is displayed which includes voters from the standard committee as well as any one-time voters.

View or Edit a Standard Voting Committee Based on Category

This link activates a page with a drop down box containing all categories in the system. To view the Voting Committee Members page, you must select one of the categories from the list and click the ***Submit*** button. From here it is possible to view or edit a voter's record by clicking on the ***person's name*** (see View or Edit Voter Records.) You can also:

Add New Voter to Standard Voting Committee

The black bar at the top of the screen contains one option field: ***Options***. The only currently available, ***Add New Voter to Standard Committee,*** activates the ***Add New Voter*** page where you can select people already entered in the system, as shown in the drop down box, or enter a new person by completing the required fields. In either case, when ***Save*** is selected, the person entered will be assigned to the standard voting committee for that category. These people will be the Senior Review Panel voters for that category.

Remove Voter

To remove a person from a single voting committee, click ***Remove from SRD*** next to the desired SRD. The individual will be immediately removed from the SRD voting committee.
To completely revoke an individual's voting privileges, click the ***Inactivate Voter Entirely*** link associated with the voter's name. The voter will be immediately removed from all voting committees in that category.

Log Off

When you have finished performing AMSO duties in the system, click the ***Log Off*** button on the navigation bar. You will see the message:

You have successfully logged out of the SNAP.

This message will be followed by a Log On screen, providing you the opportunity to log in to the system again.

Chapter 5 ~ Voting

How to Vote

You are notified of your assignment to a specific SRD voting committee by a system generated email message. The message includes the URL address for you to visit to place your vote, which is given in the following format:

> http://www.snap.army.mil/Votes.cfm?SRD_Number=SRDXXXXX&G=GGGGGG&W=WWWWWWW

There are three ways to access the system to cast your vote:

- Depending on the mail program you use, it may be possible to access the voting page directly by clicking on the URL from within the message.
- Copy the URL from the message and enter it into the address line of a web browser.
- Access the SNAP application directly and click the *Vote* button on the navigation bar. Use the login and password provided in the email message you received.

After accessing the voting page, follow the instructions given in Chapter 2: **A Tour of the SNAP Application, Vote section**, of this manual.

Chapter 6 ~ Typical Work Flow

Introduction

The nomination and approval process flows from beginning to end in an orderly and progressive manner. Although it is possible for an SRD to be recategorized, withdrawn or returned back to the beginning of the process from almost any point, the majority of nominations will follow the fundamental path described below.

Initial Submission

The SNAP process begins with the nomination of a potential standard. This nomination is immediately assigned a system-generated number for tracking purposes. Now called a "Standards Requirement Document" (SRD), the submission is identified throughout the system by this number, which takes the format "SRD_XXXXX." The data is saved in the system and the following email message is sent to the appropriate SCC and AMSO:

Subject: SRD_XXXXX - New Submission

To: Primary Category SCC
Re: SRD_XXXXX Title
Submitted On: MM/DD/YY

SRD_XXXXX Title has been submitted under Category Name by POC Name. It is waiting your review.

If you accept this submission and feel it should be pursued, please collect all required additional information. Once ready for public review, access the SNAPat:

http://www.snap.army.mil

Select the "ADMIN" button. You will be asked to log in. Enter the category password. After logging in, you will have access to any submissions awaiting your review. Select SRD_XXXXX and it will be displayed. You may make whatever changes you deem appropriate. Finally, after all changes have been made, select the Request Status Change option from the options bar at the top of the page and select the desired new status. Add whatever comments you wish to include.

A brief description of the submission is provided below for your information.

Description: Brief description

Submitted by:

POC Name
POC Address
POC City, State Zip Code

Phone: POC Phone

When this message is received, the SCC reviews the SRD and takes one or more of the following actions:

- Decide whether or not the SRD is valid and worthy of further investigation. If the SRD is not valid, the SCC accesses the system and deletes the submission. (Please see Chapter 3,**Editing Options** for instructions on how to delete a submission.)

- Decide if the SRD was submitted under the appropriate category. If necessary, the SCC can access the system and request the SRD category to be changed. (Please see Chapter 3,**Editing Options** for instructions on how to request a category change.)

- If it is decided the SRD is valid and was submitted under the correct category, the SCC accesses the system and requests the status to be changed to ***AMSO and Domains Should Review***. (Please see Chapter 3, **Editing Options** for instructions on how to request a status change or how to delete an SRD.)

Request Status Change

After the SSC completes the ***Request Status Change*** page, the following email message is sent to AMSO:

> From: SCC
> To: AMSO
>
> SRD_XXXXX Title
>
> has been reviewed and is ready to move
>
> From: Initial Submission
>
> To: Under Review at AMSO and Domains
>
> Comments: SCC Comments

Change Status

Upon receipt of the previous message, AMSO will review the request and decide whether or not to comply. If it is decided that the status be changed, AMSO must access the system and change the status for that SRD. Following the example given above, AMSO would log in and change the status from *Initial Submission* to *Under Review at AMSO and Domains*. This change will generate email messages to the submitter, all SCCs, and the primary category reflector, as follows:

TO: POC, Primary SCC, Reflecto
CC: All other SCCs

SRD_XXXXX Title

has been reviewed and found to be a valid requirement. It has been sent to the Reflector and is open for review andcomments

Prepare Voting Package

Prior to reaching the *Prepare Voting Package* status, an SRD must be classified *Under Review at AMSO and Domains*. Discussion on the nomination has been on-going, monitored by the primary category SCC. When the primary SCC decides a consensus on the disposition of the nomination has been reached and the review process should be closed, he will again access the *Request Status Change* page.

Another email message will be generated and sent to AMSO, in the same format as shown in the *Request Status Change* above, this time requesting the status be changed to *Prepare Voting Package*.

At this point, off-line documentation is gathered and the SCC, along with AMSO, prepares voting packages and places them in ASTARS for the Voting Members to access and review.

Assign Voting Members to this SRD

Any time after an SRD moves into the *Under Review at AMSO and Domains* status and while discussion is still open, AMSO can access the system and assign voting members to the SRD. This option can be accessed as many times as necessary to adjust the voting committee until voting is actually initiated.

No email messages are generated when a committee member is assigned; only when AMSO initiates voting will members be notified of their voting assignment.

Start Voting Process

Once the primary SCC and AMSO have prepared and distributed voting packages to all voting committee members, the SCC re-accesses the *Request for Status Change* page.

A mail message will be generated and sent to AMSO, in the same format as shown in *Request Status Change* above, this time requesting the status be changed to *Start Voting Process*.

Voting in Process

When AMSO receives the *Request Status Change* message from a SCC to start the voting process, an AMSO coordinator must access the system and select the *Initiate Voting Process* option. It is at this point, when AMSO sets the voting close date and clicks the ***Start Voting*** (Email Committee Members) button, that all voting committee members receive messages notifying them of their voting assignment, as follows:

> FROM: AMSO
> TO: Assigned Voters
> SUBJECT: SRD_XXXX - Voting Assignment
>
> You have been assigned to vote on SRD_XXXXX Title
>
> To record your vote, please access the following web page:
>
> http://ww.snap.army.mil/Votes.cfm?SRD Number=SRDXXXXX&G=GGGGGG&W=WWWWWW
>
> You may record a new vote, or change a previous vote,
> at this location until the specified closing date, mm/dd/yy, is reached.
>
> In case you need it, your user login and password are specified below:
>
> USERNAME: Login
> PASSWORD: Password

When these email messages are generated, the status of the SRD is changed to *Voting in Process*.

Until the voting close date is reached, an SRD carries the status of *Voting in Process*. It is possible for SCCs and AMSO to view the current voting tally at any time by accessing the system and selecting the ***Voting Status*** option.

Upon the voting close date, the SCC accesses the ***Request for Status Change*** page. An email message will be generated and sent to AMSO, in the same format as shown in *Request Status Change* above, this time requesting the status be changed to ***Tabulate Voting Results***.

Tabulate Voting Results

When AMSO receives the ***Request Status Change*** message from a SCC to tabulate voting results, an AMSO coordinator must access the system and change the status on that SRD. An off-line summary package is assembled by AMSO for presentation to the DUSA (OR) for a final decision. Email messages are generated to all SCCs and voting committee members to notify them of the final voting results, as follows:

FROM: AMSO
TO: Primary SCC, Voting Committee Members
CC: Other SCCs

Re: SRD_XXXXX Title

Final voting results were:

YES: #
NO: #

DUSA (OR) Review

When AMSO submits the final summary package to the DUSA (OR), an AMSO coordinator accesses the system and changes the status of that SRD to *DUSA (OR) Review*. No email messages are generated by this status change.

Final Disposition

The DUSA (OR) determines the final disposition of the nomination. There are two options available – approve the nomination or reject it. If approved, the nomination is adopted as a new Army standard and the process is closed. The nomination may be approved either in the category in which it was submitted (the primary category) or under another category (re-categorized.) If the nomination is rejected by the DUSA (OR), it may be withdrawn entirely or returned for further discussion and development.

AMSO must now complete the process within the system by changing the status of the SRD to reflect the decision made by the DUSA (OR). When the final status is entered, email messages are sent to the submitter, all SCCs and the primary category reflector notifying them of the final disposition.

Chapter 7 ~ Army Standards Repository System

Introduction

The Army Standards Repository System (ASTARS) is a web-based storage application that allows users to store standards documents in a central location. This provides widespread and immediate access to standards information for those with internet connections. In addition to viewing stored standards documents, users can search and, when appropriate, browse and download stored information.

ASTARS uses a hierarchical ordering system to store and retrieve standards documents. As each layer opens, you can select specific topics to browse through. This allows multiple documents and file types to be stored and accessed under one subject title. In summary, ASTARS:

- Allows submission and retrieval of standards and supporting documents.
- Allows for editing of document information by the appointed librarian.
- Allows multiple file types of the same supporting document to be stored.
- Allows related files to be added to the standards document.
- Ensures that local files are virus-checked by the appointed librarian.
- Browses documents by categories.

The Home Page

The home page is the entry into the ASTARS collection of standards information and resources. It can be accessed by clicking the ***ASTARS*** button from the navigation bar in the AMSO SNAP application, or by using the following URL:

http://www.astars.army.mil

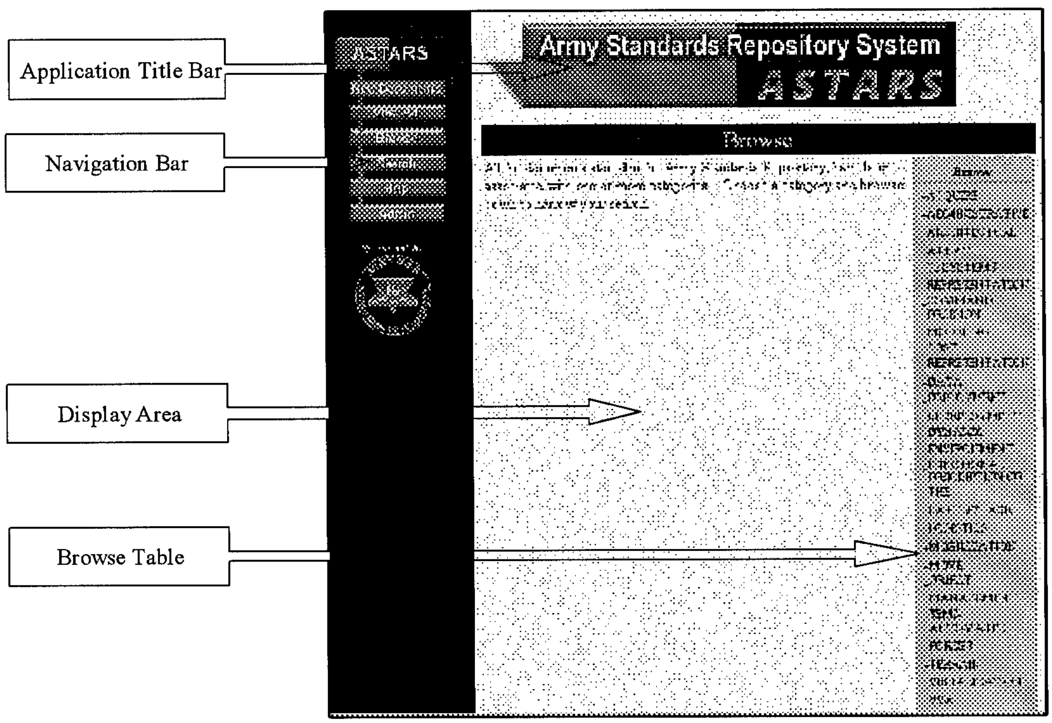
The ASTARS home page is comprised of:

- **Application Title Bar** - located horizontally across the top of the page. This bar contains the name of the application and remains constant.

- **Navigation Bar** - located vertically on the left side of the page. This bar contains buttons to access different components of the application. To retrieve the information or form you want, click on the appropriate button.

- **Display Area** - located in the middle of the page. This is the area where you can enter, edit or view information manipulated by the application. When you first enter the system, the browse page is displayed here.

- **Browse Table** – located on the right side of the page. All categories defined in the system are listed here. Linked category names indicate that the category contains standards documents. **A padlock graphic next to an item indicates it is password protected. No overall categories will be password protected, but specific information within a category can be protected.**



Locating Standards Information and Documents

If you do not know which category contains the document you require, you can search the system by selecting the*View All* or ***Search*** buttons on the navigation bar. For instructions on how to use these functions, please see the appropriate sections of this chapter.

If you know which category contains the document you require, select that category name from the Browse table shown on the Home Page. A description of the category along with a listing of its current documents will be displayed. The document title, a brief description, and submission date are provided. Documents are displayed in ascending order based on title.

Selecting a document title will display a list of supporting files. To view a specific supporting file, or receive instructions on how to retrieve it, click on the title. Small graphics may also appear next to each title and are explained in the Display Graphics section below.

Display Options

You may change the order in which documents are displayed on a page, as well as specifically define the documents selected for display, by manipulating the options available in the black bar at the top of many pages. You can:

- **Change the order in which documents are displayed.** When entering a page, documents are displayed in ascending order based on document title. To display documents in a different order, select the desired field from the drop down box generated under "***Ordered by***".

- **Change the documents displayed based on document type**. When entering a page, documents of all types are shown. To display documents of a specific type only, select that type from the drop down box generated under "***Show***". Available types are document, briefing, spreadsheet, images/multimedia, minutes and database.

- **Filter the documents displayed based on keywords**. When entering a page, all current documents within that category are shown. To display documents associated with a particular keyword only, select that keyword from the drop down box generated by "***Filtered on***".

Display Graphics

When document details are provided, the following graphics may appear next to a title:

An envelope graphic indicates the document can be sent as an attachment to an electronic mail message. When you select this graphic, you will be prompted to enter your email address

A notebook graphic indicates that directions for obtaining the document have been provided by the submitter. When you select this graphic, the directions will be displayed on-screen.

A red asterisk graphic indicates that the document is available on the web. When you select this graphic, the URL to access the document will be provided.

A padlock graphic indicates the document is password protected. You will be prompted to enter a password before any further information will be displayed.

New Standards and Supporting Documents

The ***New Documents*** button on the navigation bar triggers the ***What's New*** report. Using the drop down box, you can generate a listing of the newest items added to the repository within a specified time period. Select the desired timeframe, anywhere from 1 day ago to 1 year ago, and click ***Get Report***. All standards submitted within that period will be displayed. To view a document or receive instructions on how to retrieve it, click on its title.

View All

The ***View All*** button on the navigation bar will display a list of all standards housed in the repository regardless of their associated category. The document title, a brief description, the category, and submission date are provided. Documents are displayed in ascending order based on title.

Browse

The ***Browse*** button on the navigation bar activates the Browse page, which is the same page displayed when the application is first accessed. The Browse Table, located on the right side of the page, lists all categories defined in the system.

To browse the standards in a specific category, select that category name. A list of all documents currently associated with that category will be displayed, along with a revised browse table. The revised table outlines additional levels that have been defined within that category. You may continue browsing down through the category, further refining what documents are displayed, by selecting one of these levels. To browse back up a level, click the ***Up One Level*** link at the bottom of the revised browse table.

For further information on how to locate a specific document, follow the instructions provided in the **Locating Documents** section of this chapter.

Search

The ***Search*** button on the navigation bar activates the ***Search Documents*** page. Documents can be searched by title, description, keywords, submitter, file name, or file type. Two types of searches are available, as explained below.

Simple Search

The simple search allows you to locate standards quickly. Enter a search phrase and check the desired keywords, then select ***Search***. *AND/OR/NOT* options are not available. All standards that meet the search criteria will be displayed.

You can adjust your search by selecting the *Edit Search* button. The simple search text box will be redisplayed and you may modify the criteria you previously entered.

Advanced Search

To access the advanced search page, click on the link located in the simple search text box. The advanced search area contains AND/OR logic fields and a Query dialog box that allows you to define a more thorough search of all standards. After building the query criteria, click the *Search* button.

A listing all documents that meet the search criteria will be displayed. You can adjust your search by selecting the *Edit Search* button. The query dialog box will be redisplayed and you may edit the criteria you previously entered.

Help

The ***Help*** button on the navigation bar opens a new window containing a list of topics for which help is available. Click on the desired topic for assistance.

The following buttons are located at the top of the help window and are used to navigate the help module.

- **Contents** lists the current help topics, linked to explanations and instructions.
- **Index** provides an alphabetical list of keywords, linked to definitions.
- **Back, forward and exit** help you navigate through the help pages.

Admin

The Admin button on the navigation bar will activate a screen that prompts you to enter a username and password. You may enter a Standard Category Coordinator (SCC) username and password for access to specific category standards, or the AMSO coordinator username and password for access to all category standards and system administration functions.

Standard Category Coordinator (SCC) Administration

As an SCC, you are responsible for reviewing and maintaining all standards documents received in your category. After successful logon, the Document Administration page will be displayed. You may perform various functions by choosing from the drop down box at the top of the page.

Documents

The ***Document Administration*** page is the first page displayed after successful logon, but it can be accessed at any time after logon by selecting ***Documents*** from the drop down box at the top of the page.

When you first enter this page, only pending standards are displayed. You can change the display order, or redefine which standards are displayed, by using the options available in the black bar at the top of the page.

- **Change which standards are shown based on status.** When first entering this page, only pending standards are displayed. If you wish to redefine which standards are displayed, or change the order in which the titles are shown, select the desired status or order from the drop down box generated under "*View*".
- **Change which standards are shown based on document type.** If you wish to display standards of a specific type only, select the desired type from the drop down box generated under "***Show***". Current types include document, briefing, spreadsheet, images/multimedia, minutes, and database.
- **Filter which standards are displayed based on keywords.** To display standards associated with a particular keyword only, select that keyword from the drop down box generated under "***Filtered on***". Current keywords include algorithms, architecture, data, object, practices, procedures, references and techniques.

Listed beside each standard title are the options of***Edit, Delete, Approve, and Hide***, which are explained below.

Edit

Selecting ***Edit*** brings up the Document Editing page populated with information on file in the system for that standard. You may change any information in the text boxes.

Categories

To add or remove the standard from your category, select the ***Categories*** button at the bottom of the page A new window will open. Click the category name on the left side of the window to associate the standard with your category; click the category name on the right side of the window to remove the standard from your category. When finished, press Submit to finalize your changes.

Change File Information

To manage the files associated with a standard, select ***Change File Info*** from the bottom of the page. A

new page will be displayed listing all current files. From here you can:

- **Add a New Item**. This allows you to add a new file associated with the standard.
- **Edit Information** for any specific file listed.
- **Delete a File.**

Delete

Selecting ***Delete*** brings up an alert window asking you to verify the delete operation. You can delete the standard by selecting ***OK***.

Approve

To change the status of a pending standard to approved, select ***Approve***. The status will be changed and the standard will become immediately current and active in the standards repository.

Hide/Unhide

Selecting ***Hide*** changes the status of the selected document to Hidden. For hidden files the option of ***Unhide*** is provided. A hidden file is not shown in any system display, and cannot be viewed or accessed by anyone other than a category administrator.

Categories

To password protect a category, select the ***Categories*** option from the drop down box at the top of the page. The current password for the category is displayed, and you may enter the new password in the text box provided and select ***Save***. The new password takes effect immediately.

Add New Document

To submit a new document to ASTARS, select ***Add New Document*** from the drop down box at the top of the page. The Document Nomination Form will be displayed. Here you can enter all available information in the text boxes. Indicate the File Sharing Process to be used for that document and provide a password if you wish to protect the document. When you are finished, select the ***Continue*** button.

All information entered will be displayed for your review. Select the ***Continue*** button if all data is correct, if not, select the ***Edit*** button to change the information. When finished, your document will be virus checked and then submitted, with a status of pending, to the SCC for review before being stored in the system.

Log Off

When you are finished performing SCC duties in the system, select ***Log Off*** from the drop down box at the top of the page. The initial Browse page will be displayed.

AMSO Administration

As the AMSO coordinator, in addition to performing all SCC functions, you are responsible for the additional administrative functions required to maintain the system. You are in effect the system "superuser", as explained below.

Standards Information and Documents

The Document Administration page is the first page displayed after successful logon, but it is also accessible any time after logon by selecting ***Documents*** from the drop down box at the top of the page. When you first enter this page, all documents stored in the system for all categories are displayed. To change the order in which documents are displayed, or redefine which standards are selected, you can use the options available in the black bar at the top of the page.

As the AMSO coordinator you can perform all duties described in the **Standard Category Coordinator (SCC) Administration, Documents** section of this chapter for every category instead of just one selected category. Please refer to that section for further assistance.

Administrators

A Standard Category Coordinator is responsible for reviewing and maintaining standards within the assigned category. As the AMSO coordinator, you are responsible for assigning and managing SCC or administrator data. To manage these records, select ***Administrators*** from the drop down box located at the top of the page.

Edit/Delete Current Administrator Record

To edit an administrator record, click on the person's name. A new window will open populated with data already on file in the system for that administrator. Make any necessary changes and select ***Save***. To delete the administrator record,

select *Delete*. To change the category the administrator is associated with, or to assign the administrator to an additional category, select *Categories*.

Assign New Administrator

To assign a new administrator, select the *New Admin* button located at the top of the page. Fill in the text fields that appear in the new window. You must assign the administrator to a category by selecting the *Categories* button. A new window will open listing the available categories. Click on the desired category and it will be moved to the right of the window. You may select as many categories as you require. When complete, select *Submit*, then select *Save*, and the new administrator will be assigned to the selected category.

Standards Categories

As the AMSO coordinator, you can assign a password to any standards category instead of just one category. To password protect a category, select *Categories* from the drop down box. Current passwords for all categories will be displayed. Enter new passwords in the text boxes and select *Save*. The new passwords take effect immediately.

Add New Document

The procedure for submitting a new document to ASTARS is the same regardless of your status. For instructions, please refer to the **Standard Category Coordinator (SCC) Administration, Add New Document** section of this chapter.

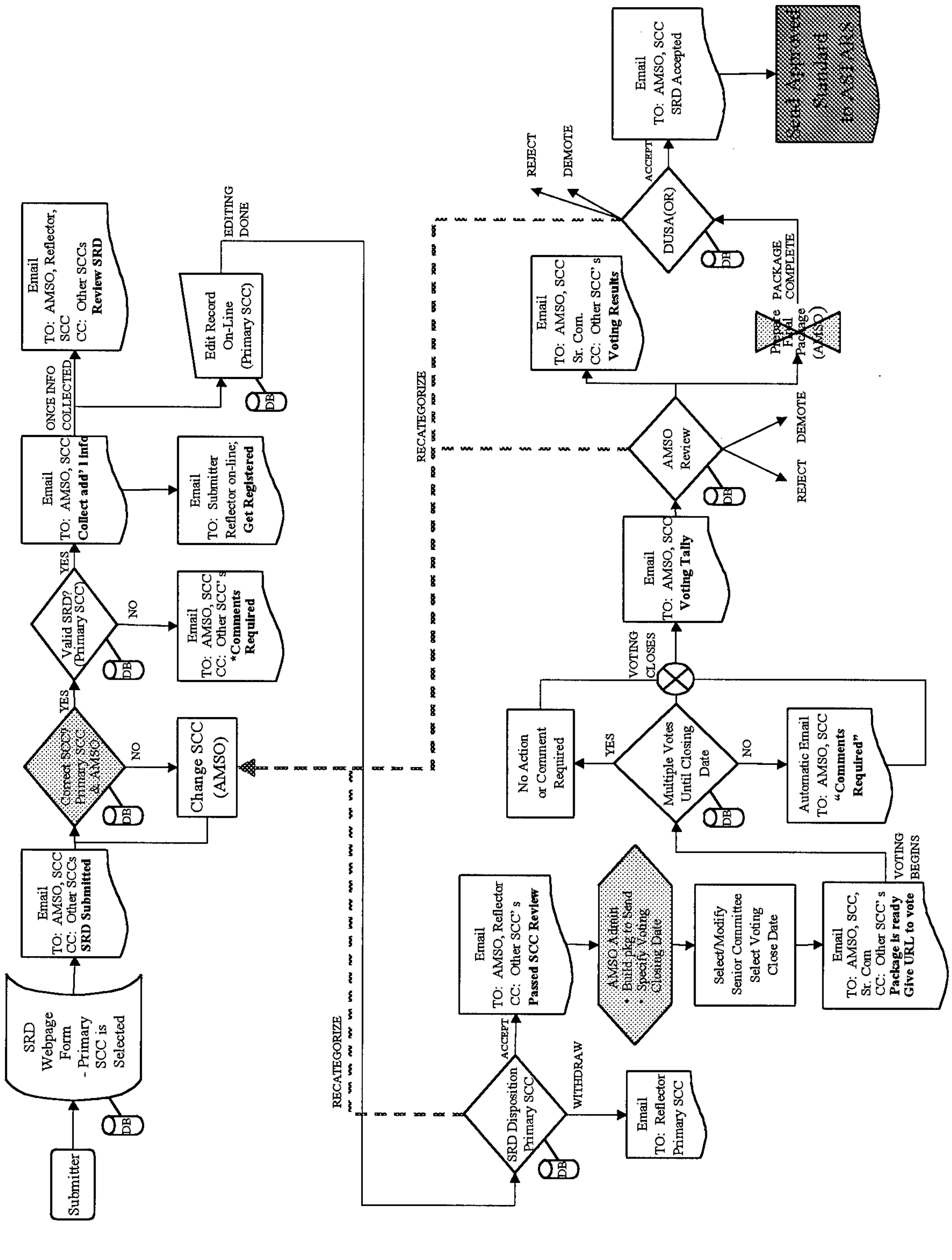
Password Report

To view a listing of all document passwords currently in use in the system, select *Password Report* from the drop down box at the top of the page. A listing of all documents and associated passwords will be displayed.

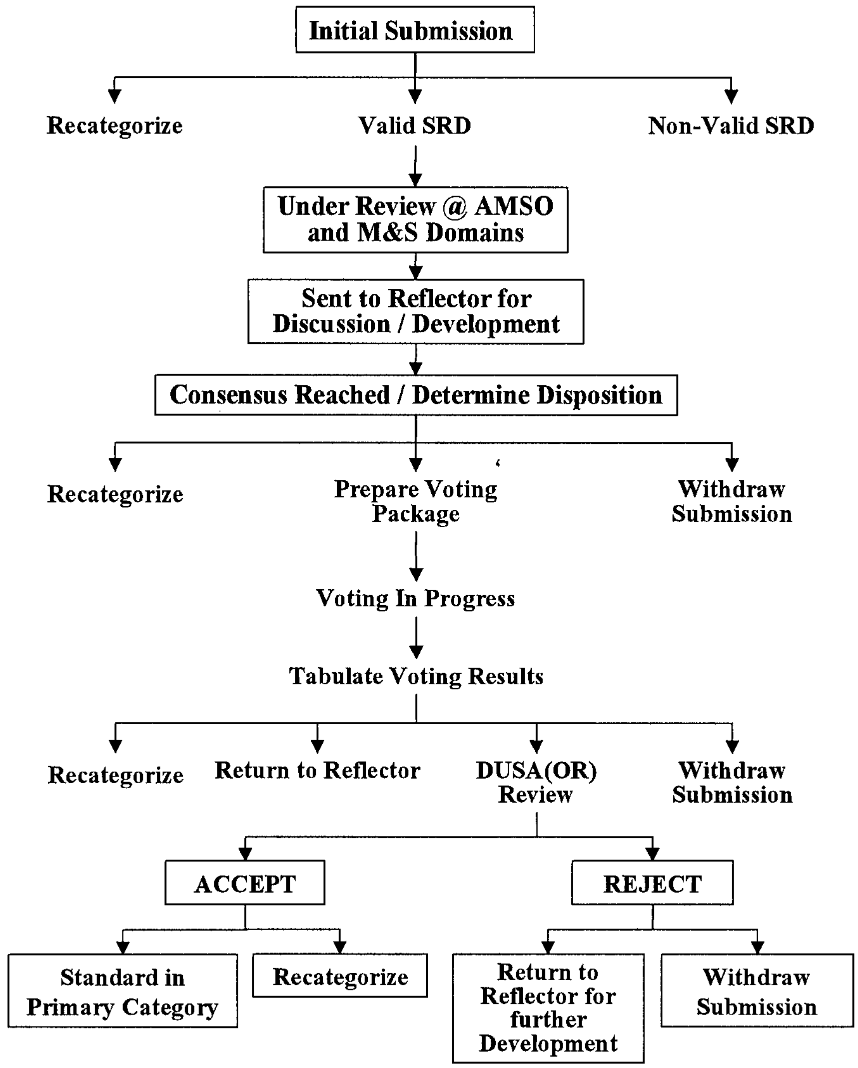
Log Off

When you are finished, select *Log Off* from the drop down box at the top of the page. The initial Browse page will be displayed.

Appendix A
Application Flowchart



Appendix B
Status Chain



Effects of Changing a Status

The status of an SRD changes as the nominated standard flows through the tracking system. It is important to maintain a document's current status for two reasons:

- When the status change is saved, all appropriate personnel are automatically notified by electronic mail.
- Changing the status provides everyone with an accurate reflection of the SRD's current state and ensures system reports are correct.
- As an SRD moves through the approval process, the new status options available vary depending upon the current status. For example, it is impossible to select "Voting in Process" if the current status is "Initial Submission".

The Status Chain graphically outlines which status options are currently active in the system and depicts their flow through the system. Generally, it is only possible to select a new status one level below the current SRD status.

Appendix C
Glossary

AMSO. Army Model and Simulation Office.

Assigned Committee Members. Senior Subject Matter Experts (SMEs) selected by a Standards Category Coordinator (SCC) and approved by the DUSA(OR) to vote on a specific SRD.

ASTARS. Army Standards Repository System. Web-based electronic storage application that allows users to store standards documents in a central, secure location.

Category Administrator. The person responsible for reviewing and maintaining all document submissions in the ASTARS application.

Checkbox. Displayed on a web page as a simple box that can be checked or empty; used to indicate yes/no values.

Current Voting Committee. People registered to vote on a specific SRD. Committee members may be part of the Standard Voting Committee for that category or be registered as a one-time voter.

Domain. The domain to which an SRD belongs (selected from a pre-defined list).

Drop Down Box. Displayed on a web page; provides a list of acceptable values for a field.

DUSA (OR). Deputy Under Secretary of the Army (Operations Research)

E-Mail. An electronic mail message sent across a network, such as the Internet

Hidden Document. A hidden document is not shown in any system display and can only be viewed or accessed by the Category Administrator or AMSO coordinator or the ASTARS representative.

Home Page. The first screen you encounter when connecting to a web site.

Justification. Reason an SRD is needed (selected from a pre-defined list).

Keywords. Significant words related to the SRD, useful when conducting searches.

Link. Displayed on a web page as a button or underlined word; when selected it takes the user to the referenced web page.

One-Time Voter. Person registered to vote on a specific SRD only; this person is not a member of the Standard Voting Committee for that category.

Original Submission Date. The date a SRD was first entered into the SNAP system.

Page. Please see Web Page.

PM. Program Manager.

POC. Point of Contact. The person to contact for questions related to a specific SRD or ASTARS document.

Reflector. A capability provided to users to subscribe to an electronic conference whereby all messages sent by all subscribers are echoed to all current subscribers. Thus, by sending a message to the electronic conference (reflector), all subscribers receive a copy even though you did not address it to them directly.

SCC. Standards Category Coordinator. The person responsible for all actions within the assigned category.

SNAP. Standards Nomination and Approval Process. A web-based application developed for the Army Model and Simulation Office (AMSO) used to track, validate and vote on suggestions received from the Model and Simulation community for consideration as new Army-wide standards.

SRD. Standards Requirement Document. Acronym used in combination with a system generated number to identify standards nominations.

SRD Number. Unique identification number generated by SNAP upon initial submission in the format ***SRD_XXXXX***. This number stays with the nomination throughout the approval process and will also remain with the standard in ASTARS.

Standard Voting Committee People registered as eligible voters for a specific category. Members are assigned to voting committees by AMSO. A member may or may not be assigned to a Current Voting Committee.

Status. The point in the review process where the SRD currently resides. As the status changes, appropriate personnel are notified by electronic mail.

Status Chain A graphical representation of the stages an SRD passes through in the approval process. Each stage name represents a status. Generally, it is only possible to move one status below the current status at any time.

Status Effective Date. The date on which the current SRD status took effect.

Text box. Displayed on a web page; used as an area in which users enter or edit information.

URL (Uniform Resource Locator). A URL is an address specifying the type and location of an information resource on the Internet. More simply stated, a URL is a pointer or link to different locations on the Internet.

Voting Close Date. Date voting on an SRD ceases, determined by AMSO.

Voting Committee Members Same as Standard Voting Committee.

Web Browser. A program (software) used to access and view information resources on the World Wide Web (WWW).

Web Page. One of several pages that make up a web site. Web pages are hypertext documents. A site's primary web page is also referred to as its "home page".

Web Site. A collection of information resources on the WWW maintained by an individual, corporation, or public institution.

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